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THE UNIVERSITY OF ALBERTA

CORRELATES OF CREATIVE ABILITY AND PERFORMANCE IN HIGH SCHOOL STUDENTS

BY

JAMES A. ORIEUX

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE

OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

SPRING, 1989

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(Supervisor)

Peter Calder

Thomas Blowers

Date: ....

DEDICATION

To Bev, Anne and Keith;

to the cats, past and present

ABSTRACT

Correlates of creative ability and performance were investigated for 157 grade 11 students (81 males and 76 females) from an urban-rural public high school. Creative ability was assessed with the Wallach-Kogan divergent thinking tests and creative performance was assessed from three sources: the Creative Activities Checklist (Runco & Albert, 1985), completed by students, the Teachers' Evaluation of Students' Creativity (Runco, 1984), and the Parents' Evaluation of Students' Creativity, adapted from the latter for this research.

Correlational analyses were conducted to determine the relationship of the creativity measures with intellectual ability, assessed with a group intelligence test, and academic achievement, obtained from school records data. The creativity measures demonstrated significant internal reliability and convergent validity for this sample. Correlations based on total sample scores revealed that both creative ability and performance were significantly related to intellectual ability and academic achievement at moderate to low levels.

The threshold theory, which posits that creativity and intelligence are related only up to an IQ of approximately 120, was investigated for students assigned to four IQ groups, with the High Ability group having an IQ range of 125 to 150. Correlational analyses between IQ and creativity, and achievement and creativity (within four IQ groups) resulted in overall low and non-significant correlations for all four groups. These results did not support the threshold theory.

Multivariate analyses of variance conducted to evaluate gender effect for all measures revealed that females significantly differed from males: females obtaining higher mean scores on two achievement measures (Provincial Achievement Test - total and multiple choice scores) and on two creativity measures (divergent thinking and the reporting of creative activities).

Profiles of High and Low Creatives, developed from rank-ordered data on each creativity measure, provided a comparative examination of the students' characteristics with respect to intellectual ability, academic performance, general interests, and creative activities. Results were expressed partly, in a descriptive analysis and provided pertinent data for future assessment of creativity.

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CHAPTER I

INTRODUCTION

Research on creativity represents a controversial area which raises more questions than solutions. The concepts of creative ability and creative thinking, in spite of extensive research since the 1950's, have eluded operational definition and generally agreed-upon quantitative measurement. Nevertheless, the notion of creativity has gained recognition in the field of education, especially as it pertains to the "gifted and talented". Creative ability and/or performance are generally accepted as components in several definitions of the gifted and talented (e.g. Marland, 1972; Renzulli, 1977, 1978; Alberta Education, 1986).

The utility of definitions is explicit in the identification and selection of students for gifted programs. However, there may be additional value in identifying characteristics of creative thinking ability and performance in a general student population with the purpose of addressing student needs which may well be beyond academic achievement and scholastic ability, and which may possess a closer relationship to a student's talents, non-academic pursuits, and future goals.

The Problem

There are students with abilities sometimes referred to as "gifts" or "talents", which are not fully expressed within the context of scholastic ability and academic achievement, nor measured with traditional tests of intelligence, aptitude and achievement, including school-assigned grades in various subject areas. There is a body of research (e.g. Albert &Runco, 1986; Barron & Harrington, 1981; Bloom, 1985; Dellas & Gaier, 1970; Getzels & Jackson, 1962; Guilford, 1971; Holland & Austin 1962; Holland & Richards, 1966; Milgram, 1984; Runco, 1986c; Wallach & Wing,

1969) which supports the recognition and development of creative abilities because they are often equally or more predictive of eventual "real-life" accomplishments than are the traditional predictors of intellectual ability and academic achievement for such talent areas as creative writing, scientific innovation, music, art and drama. It is held that creative or talented students may be overlooked in obtaining appropriate educational opportunities and recognition for talent areas. Indeed, it is evident that the criteria for educational advancement, scholarships and admission to college, university or other institutions of learning, is very much skewed toward academic achievement and intellectual ability. The problem is exacerbated by the absence of a recognized definition of "creativity" and by the difficulty in applying psychometric measurement methods to this construct comparable to those used in assessing intellectual ability and academic achievement.

Restricting our view of intelligence or perhaps the abilities of gifted and talented"individuals to the relatively narrow metric of IQ and to scholastic achievement, is a problem equally to be challenged. There is notable support in the literature for the notion of creative ability as an interaction of cognitive abilities not necessarily tapped by IQ tests (eg. Barron & Harrington, 1981; Getzels & Jackson, 1962; Guilford, 1950, 1956, 1957, 1967, 1971, 1977; Hocevar, 1980; Milgram, 1984; Milgram & Milgram, 1976b, Renzulli, 1977, 1978, 1986; Sternberg & Davidson, 1983; Torrance, 1981a; Treffinger, 1981, 1986; Treffinger, Renzulli & Feldhusen, 1971; Wallach, 1985; Wallach & Kogan, 1965; Wallach & Wing, 1969). The distinction is made between IQ tests, which tend to focus on acquired knowledge and "convergent thinking", and creativity tests which, by contrast, require "divergent thinking" and focus more on abstract and novel stimuli.

Treffinger (1986) addresses the problem of identifying creativity and our quest for the elusively perfect creativity test:

> Perhaps the greatest problem regarding creativity identification in gifted education . . has to do with the persistent fallacy that there should be an instrument which will yield a single score or index of a student's "creative giftedness" so that students can be more effectively included or excluded from gifted programs . . . (p. 15).

Treffinger then points out an important approach to consider:

> The greatest potential use of creativity assessment tools (and probably for most other assessment tools, too!) in gifted education lies in expanding our ability to develop a more comprehensive profile of the student's style, characteristics, and needs; that is, creativity assessment data should be used diagnostically, to guide instructional planning, rather than merely as criteria for selecting students (p. 16).

Research on creativity has been carried out with virtually every age group in a school-age population and with adults. One contrast worth noting is that there does not appear to be a linear relationship in predicting adult creative accomplishment from childhood creative ability measures, as is the case with the prediction of adult scholastic potential from childhood IQ scores. The research tends to indicate that creative accomplishments in adulthood likely are determined in later adolescence (e.g. high school years). However, there is a relative paucity of research conducted with high school students for the purpose of investigating the characteristics which may be predictive of future creative production, and for the purpose of enhancing such talents during the high school years. Yet, this age group provides a relatively stable population for study. High school students should have sufficient experiences to contribute valid "self-report" information on past accomplishments and frustrations as well as on future goals. Milgram (1984) observes that:

> The tests most widely used to measure "creativity" in school settings or in the process of selection for special programs usually are measures of divergent thinking ability. In addition, personality measures have sometimes been included. Biographical inventories consisting of questions on nonacademic accomplishments in a wide variety of spheres are far less frequently utilized. In light of these findings on the constancy of creative behavior, this situation seems most unfortunate. Self-report questionnaires of past creative activity could well be the best available predictor of future performance and and as such, merit inclusion in selection batteries for programs serving promising young adults (pp. 38 - 39).

In summary, the problem has been presented as a twofold issue: (1) the need to recognize and identify creative abilities and performance which may not be evident in the results of intelligence and academic achievement test results, and (2) the recognition that in attempting to measure creative ability or performance, there is not likely to be one index or test yielding a creativity score.

Purpose of the Study

The purpose of this study was to investigate the correlates of creative thinking ability and performance in a high school student population. The first objective was to determine whether the use of several measures of creativity within a school setting would be viable; that is, whether the instruments used would have internal reliability and convergent validity. The second objective was to determine whether students rated as high creative would also be students rated as possessing high ability and as being high academic achievers, and whether there would be any notable differences between males and females on all measures. The third objective was to examine similar and contrasting characteristics between 'high' and 'low' creatives and to develop descriptive profiles on selected students from each group.

It was felt that the results of the study could provide educators with a basis from which to address the needs of students whose special abilities and talents may not be evident from the results of scholastic ability and academic achievement measures, nor met in the current high school classroom experience.

Delimitation of the Study

This study of creativity has set out to investigate "creative thinking ability" and "creative performance" in an educational setting using grade eleven students as the sample population. Creative thinking ability has been defined operationally through the use of a divergent thinking test battery. Creative performance has been defined operationally through the use of three measures: a student "self-report" checklist on creative activities, a rating of students by their parents on characteristics of creativity, and a similar rating of students by their teachers.

Creative ability and performance have been investigated in relation to students' intellectual ability, measured by a group-administered ability test; and to students' academic achievement which was derived from data made available through school records. The achievement data, selected on the basis of availability for the majority of the students, came from two sources: standardized test information (Provincial Achievement Test) and teacher-assigned marks (grade 10 core subjects). Anecdotal information from school records and from a brief interest inventory administered during the study provided additional data for the development of descriptive profiles for two groups of students selected as 'high' and 'low' creative.

Research Questions to be Investigated

Based on the above criteria for determining creative ability and performance, intellectual ability and academic achievement, the following questions have been considered for investigation:

1. Will the instruments used to measure creative thinking ability and performance with this sample demonstrate significant internal reliability?

Although the instruments selected, with the exception of the parent rating scale, have been used in previous research, it is considered important to establish the internal reliability of each with the current sample of Grade 11 students. For the parent rating scale, being introduced at this time, it is essential to establish internal reliability.

2. Will the creativity measures intercorrelate significantly to indicate that they are measuring the same construct (convergent validity)?

The creativity measures selected represent various approaches to the assessment of creative ability and performance: divergent thinking tests, student self-report of creative activities, parent and teacher ratings of student creativity. In comparing data from these measures with measures of intellectual ability and academic achievement, the convergent validity of the creativity measures must be established to ensure that these instruments are measuring a common construct and not some independent factor.

3. How will the creativity measures correlate with measures of intellectual ability and academic achievement for the total sample?

As well as having convergent validity, the creativity measures should demonstrate independence from other measures such as intellectual ability and academic achievement.

4. How will the correlations between creativity, intellectual ability, and academic achievement, obtained for the total sample, hold for students grouped according to four ability levels (High, Medium High, Medium Low, and Low)?

This question raises the issue of testing the threshold hypothesis which puts forth the notion that creativity and intelligence are positively related in the general population up to a certain level of intelligence (eg. IQ 120), at which point creativity and intelligence are relatively independent. Given the strong relationship between intelligence and academic achievement, it was decided to extend the investigation of the threshold hypothesis to achievement as well.

5. Will males and females differ significantly on any of the measures administered?

The research on gender differences is inconclusive with respect to creative ability and general creative performance, as well as intellectual ability and academic achievement. It is considered important to determine whether there are significant differences between males and females on these measures.

6. Having selected the top 15 students (High Creative) and bottom 15 students (Low Creative) on six creativity measures, how will the two groups compare on each measure in terms of average intelligence and achievement test scores?

This question, also related to the threshold hypothesis, is designed to investigate comparative groups on each creativity measure to establish whether High Creatives will also be the high ability and high achievement students, and conversely for the Low Creatives.

7. Based on the data from measures of intellectual ability, academic achievement, creative thinking ability, creative performance and, in addition, anecdotal data from the interest inventory and the Creative Abilities Checklist, what similarities and differences (profile information) will emerge fora subsample of the most highly creative students (n=4) and what contrast will there be with a subsample of the least creative students (n=4)?

This question raises the importance of examining High and Low Creatives from a comparative profile approach which will include descriptive as well as statistical data.

The consideration of anecdotal information is deemed valuable in looking at common and contrasting characteristics of students.

Research Hypotheses

Based on the literature reviewed, both theoretical and empirical, and the questions formulated in the previous section, the following hypotheses are put forth:

1. Each of four measures of creativity, namely, the Wallach-Kogan Divergent Thinking Tests (DT), scored for fluency (DT-FL) and unusual responses (DT-UN); the Creative Abilities Checklist (CAL), scored for quantity (CAL-QT) and quality (CAL-QL), the Parent Evaluation of Students' Creativity (PESC), and the Teachers' Evaluation of Students' Creativity (TESC), will have significant intra-correlations demonstrating the internal reliability of each instrument.

2. The four creativity measures with their respective subtests, will intercorrelate significantly demonstrating convergent validity.

3.1. A measure of intellectual ability, namely the Otis-Lennon School Ability Test (O-LSAT) will be significantly correlated with measures of academic achievement: the Provincial Achievement Test (PATOT) - Grade 9 Language Arts, 1986 - with separate scores for the multiple choice (PAMC) and written response (PAWR) sections, the Social Studies 10 (S.S.10) final mark, and a grade point average (GPA) of Social Studies 10, English 10/13, and Math 10/13/15.

3.2. Based on the research which has generally borne out a moderate relationship between creativity and intelligence or academic achievement, the following hypothesis is put forth: for the total sample, the creativity measures will correlate significantly but at low to moderate levels with a measure of intellectual ability and measures of academic achievement.

4.1. In support of the threshold theory, correlations between creativity measures and intellectuall ability will be significant in the Low to Medium High ability groups and non-significant for students in the High ability group (i.e. with a Deviation IQ of 125+).

4.2 Based on the assumption of a significant correlation between intellectual ability and academic achievement measures, correlations between creativity measures and academic achievement measures will be significant in the Low to Medium High ability groups and non-significant for students in the High ability group (i.e. Deviation IQ of 125+).

5.1. There will be no significant differences between males and females on measures of intellectual ability and academic achievement.

5.2. There will be no significant differences between males and females on measures of creativity.

6. There will be observable differences between the High Creative and Low Creative groups within each creativity measure on average DIQ and average achievement test scores.

7. The data from the measures of intellectual ability, academic achievement, creative thinking ability, creative performance, and from the interest inventory and Creative Activities Checklist will provide observable similarities and contrasts to develop descriptive profiles for a subsample of four Most Creative and four Least Creative students.

Significance of the Study

The literature reviewed reveals that creativity has been researched in an educational context with students of all ages; that much has been written regarding the use and validation of tests of divergent thinking, self-report questionnaires and rating scales, and finally, that the relationship between divergent thinking and "real-life" accomplishments has significance. However, this has not precluded a further investigation of these issues through a combination of existing results and some novel ideas in approaching the topic. This study is considered to be significant research from the following standpoints:

1. The use of multiple criteria as operational definitions of "creative ability" and "creative performance" as opposed to one measure such as "divergent thinking" or "ideational fluency," is a relatively uncommon approach to the assessment of creativity.
2. The use of the Wallach-Kogan divergent thinking tests, in combination with Runco's Creative Activity Checklist (CAL) and Teachers' Evaluation of Students' Creativity (TESC) provides further replication of research conducted with these instruments using a heterogeneous sample of Canadian high school students.
3. The use of the TESC to formulate the Parents' Evaluation of Students' Creativity (PESC), which in effect provides a parallel use of the same instrument with both teachers and parents, represents a novel approach in the use of a social validation scale as developed by Runco (1984).

CHAPTER II

SURVEY OF THE LITERATURE

Introduction

The investigation of creativity in this study will be delimited to looking at "creative ability" and "creative performance" within an educational setting: what existing research, both theoretical and applied, offers on this topic and how it can be operationalized for the enhancement of the creative student's learning experience.

Research on creativity, based on the literature reviewed, would appear to raise more problems than solutions. The concept of "creative ability", in spite of extensive research, especially since the 1950's, has eluded operational definition and a generally accepted quantitative measurement.

Barbara Clark (1983) in her book Growing up Gifted, has expressed the problem of defining creativity and, at the same time, has emphaseized the importance of creativity as part of the concept of "giftedness":

> Creativity is a very special condition, attitude, or state of being that nearly defies definition...some have used creativity synonymously with giftedness; some have limited it to feelings and affective development. It seems incorrect to use it in either of those ways, as it has none of the limitations of those concepts; creativity includes far more. It is the highest expression of giftedness (p. 30).

Davis and Rimm (1985) have echoed the importance of creativity in gifted/talented education:

> There can be no more important topic in the education of gifted and talented children than creativity. Indeed, the two interrelated purposes of gifted education are (1) to help these children and adolescents develop their gifts and

talents and realize their potential - that is, to help them become more self-actualized, creative individuals, and (2) to better enablem ~~them to~~ make contributions to society (p. 207).

In summary, the construct of creativity has gained notable recognition in the field of education, especially as it pertains to gifted/talented students in terms of definitions (e.g., Alberta Education, 1986; Marland, 1972; Renzulli, 1978; Richert, 1985); identification criteria (e.g., Alberta Education,1986; Richert, Alvino & McDonell, 1984; Richert, 1985;); tests of creative ability (e.g., Getzels & Jackson, 1962; Guilford, 1967, 1977; Rimm & Davis, 1983; Torrance, .1966, 1974; Wallach & Kogan, 1965), and programs based on teaching creative and critical thinking (e.g., Bloom, 1956, 1963; Davis, 1981, 1982; Feldhusen & Treffinger, 1980; Guilford, 1962; Parnes, 1966, 1977, 1978; Torrance 1977, 1981b).

Defining Creativity

There is some utility in examining an abstract construct such as 'creativity' from some basic definitions:

Creative: use of *imagination*, where a new combination of ideas or images is constructed (strictly when it is self-initiated, rather than imitated); also of thought synthesis, where the mental product is not a mere summation. (*Penguin Dictionary of Psychology*, Drever,1965, p. 56).

Creativeness: n. ability to find new solutions to a problem or new modes of artistic expression; bringing into existence a product new to the individual (not necessarily new to others) - var. *creativity.* (English & English, 1958, p. 129).

> creativity: the ability to make or otherwise bring into existence something new, whether a new solution to a problem, a new method or device, or a new artistic object or form. (Encyclopaedia Britannica, 15 Ed., 1973 - 74, p. 227).

From the latter reference quoted above, there follows a more elaborative summary of creativity which points to psychological research directed towards the fields of motivation and learning:

> There appears to be an essential and continuous tension in higher organisms between, on the one hand, the establishment and maintenance of environmental constancies, and on the other, the interruption of achieved equilibrium in the interest of new possibilities of experience. Psychological studies of highly creative people have observed this tension in terms of such dualities as intellect and intuition, the conscious and the unconscious, the conventional and the unconventional, and complexity and simplicity (p. 227).

As with the formulation of most theoretical constructs or models desinged to operationalize and explain human behavior, researchers have clustered around models or theoretical positions in defining creativity or subconstructs such as 'creative thinking ability'. Clark (1983) provides a concise summary of the various approaches in the research literature pertaining to creativity and giftedness. She refers to the "rational view" of creativity as having accumulated the most literature and nearly all of the testing (p. 33). The leading advocates of the rational thinking positions are identified: Guilford (1959), C.W. Taylor (1959), Torrance (1962), Parnes (1967) and Williams (1968). From the researcher's observation, the common factor of this approach is that 'creativity' is perceived as the sum of identifiable processes or subconstsructs which can be measured by instruments designated as measures of creativity. Clark then refers to those who view creativity as a function of feeling (e.g. Maslow, 1959; Fromm, 1959; Rogers, 1959; May, 1959) by focussing on the well-being and self-actualization qualities (p. 39); as a function of talent (e.g. Maslow, 1959; Rogers, 1959; May, 1959); as a function of high levels of consciousness (e.g. Anderson, 1962; Taylor, 1963; Koestler, 1964); and finally, the integrative approaches to creativity (e.g. Callaway, 1969; Gowan, 1972; Ferguson, 1973). Clark supports the latter approach. She states:

> Inside of me I believe that everyone who has defined or discussed creativity is right, though their positions sound disparate. And at the same time, they are wrong because they speak of only the part of creativity that they see or that fits their belief system. Such a limited view of creativity has caused us to recognize only a portion, an isolated part of what, in fact, is a far more complex, more integrated whole (p. 30).

Barron and Harrington (1981) in their introduction to an extensive review of creativity, intelligence and personality, refer to the varieties of 'creativity' put forth in the research literature. They state that "...the term creativity stands in need of precise distinctions among the referents it has acquired (p. 441). Three ways in which commonly used definitions of creativity vary are presented: (1) definitions requiring socially valuable products, while others view creativity itself as intrinsically valuable, (2) definitions which may vary in terms of the level of accomplishment recognized as creative, and (3) distinctions of creativity as achievment, creativity as ability, and creativity as disposition or attitude (p. 441).

Davis and Rimm (1985) focus more on the traits and characteristics of creative people, citing works done in the areas of personality, motivation and biographical research (e.g. Barron, 1969; MacKinnon,1978; Smith,1966; Torrance, 1981a).

Their approach is manifested in the development of group inventories (Rimm, 1976, 1982; Davis and Rimm, 1979, 1982) based on a characterisitics approach to identify creativity (Rimm, Davis and Bien, 1982), which represents a departure from the usual tests of divergent thinking. They propose that a group-administered inventory and/or parent-report inventory evaluates psychological, personality, motivational and biographical traits which usually characterize creative people (p. 165). They further see their inventory approach as being "...an efficient and effective method of selecting creative students for gifted programs when combined with at least one other method" (p. 171).

The above discussion has presented a brief view of both theoretical and operational research literature pertaining to the definition of creativity, with the emphasis on creativity as a component of giftedness.

Taking direction from the above sources and from the overall review of the literature on creativity, a definition of creativity, for the purpose of this study was developed. In doing so, it was important to maintain a focus on certain delimitations, namely, the consideration of both creative thinking ability and creative performance for a heterogeneous sample (as opposed to an identified group of gifted/talented students) within a high school population. From a theoretical viewpoint, the defintion developed below embodies an integration of the 'rational' and 'traits/characteristics' positions:

A creative adolescent will generally be recognized through the following abilities and characteristics:

1. a measured intellectual ability at least in the high-average range;
2. academic achievement at an above-average but not necessarily high level with respect to school assigned grades;
3. a high level of divergent thinking in terms of ideational fluency and uniqueness of ideas;

4. an awareness of own interests and accomplishments; relatively expressive in discussing these in a purposeful manner; able to relate interests/talents or personal pursuits to 'real-life' goals;

5. interests, in a variety of areas, with one or two areas being developed more seriously as talents (may be vocational or avocational);

6. perceived by significant others (parents, peers, teachers) as demonstrating individual qualities or characteristics such as independence, originality of ideas, non-conforming, both a problem-finder and problem-solver, and usually questioning beyond the factual information available. It should be noted that some of the above characterisitics may not be considered as acceptable to others and, hence, not interpreted as creative behavior.

The above definition may be capsulized with respect to the multidimensional sources of information required in identifying a creative adolescent: data from measurement of intellectual ability, academic achievment, and divergent thinking; information from the individual under study through self-report, autobiography, personal interview, rating of products or accomplishment as creative performance, and perceptions from significant others through rating scales or interviews, on the individual's creative performance.

As expressed by R. S. Albert and M. A. Runco (1986) in their discussion of the achievement of eminence, "creative persons from adolescence through adulthood are remarkably identifiable insofar as their psychological traits and dispositions are concerned" and they further have suggested that "...creativity is a blend of processes and values that motivate and infuse behavior, selective attitudes, and personality traits" (p. 340). The recognition of creativity from a multidimensional perspective, especially in research pertaining to gifted individuals, is relatively recent as we observe in the following section.

Study of Creativity

Guilford's presidential address to the American Psychological Association (Guilford, 1950) is well recognized in the literature as the pivotal point in directing research toward creative ability and in challenging the almost unequivocal acceptance of intelligence (represented by a unitary IQ score) as the criterion determining giftedness or eminence. Guilford observed that his examination of the contents of intelligence tests revealed very little that was of an obvious creative nature. He stated:

> If the correlations between intelligence test scores and many types of creative performance are only moderate or low ... it is because the primary abilities represented in the tests are not all important for creative behavior. It is also because some of the primary abilities important for creative behavior are not represented in the test at all ... In other words, we must look well beyond the boundaries of the IQ if we are to fathom the domain of creativity (pp. 444-445).

Guilford's development of the Structure-of-Intellect Model (Guilford, 1956, 1959, 1967; Guilford & Hoepfner, 1966) provided the impetus for the study of intelligence from a multi-dimensional perspective and, more specifically, for looking at creative ability through the processes of convergent and divergent thinking. Prior to Guilford's influential contribution, it is fair to generalize that the focus on "giftedness" was mainly influenced by Lewis Terman's Genetic Studies of Genius (Terman, 1925, 1959; Terman & Oden,1947), a monumental longitudinal study of 1500 "gifted students" (800 boys and 700 girls). Research has continued in recent years on this study (R.R. Sears, 1977; P.S. Sears, 1979; Sears & Barbee, 1977). Terman's subjects comprised the top one to three percent on IQ scores in California schools. Getzels and Jackson (1962) observed that "The child who did not have a high IQ, no matter how accomplished in other respects, was not considered "gifted" [hence, not part of the investigation]" (p. 2). Giftedness was synonymous with high IQ.

E. Paul Torrance is generally recognized as having made one of the most significant contributions to the study of creativity through the development of the Torrance Tests of Creative Thinking [TTCT] (Torrance, 1966, 1974; Torrance & Ball, 1984). Drawing from Guilford's model, Torrance focused on divergent thinking abilities, assessing the components of "ideational fluency", "ideational originality", "ideational flexibility", and "elaboration". In developing measures of creative thinking abilities, Torrance (1974) expressed his belief that such instruments could yield a useful basis for making instruction different for different students and that the TTCT probably represented the first time that a battery of such tests had been made available for general use, at least with children (p. 10). Indeed, the use of the TTCT and Torrance's additional contributions in developing stratgegies for creative thinking and problem solving (Torrance, 1977, 1981b, 1984), have raised the awareness of looking at the "gifted and talented" individual from a broader perspective.

Bloom's Taxonomy of Educational Objectives, I: Cognitive Domain (1956), which has guided curriculum development and test construction in the past three decades, has also provided a framework from which to expand the approach to teaching and broadening the teaching/learning experience beyond the well-known and applied levels of knowledge, comprehension and application. The development of the higher levels of analysis, synthesis and evaluation have been central to the development of programs to challenge gifted and talented students. Bloom (1956) referred to "synthesis" as " ... the category in the cognitive domain which most clearly provides for creative behavior on the part of the learner" (p. 162).

Treffinger (1981) has described four major reasons for the importance of creativity in gifted education, "Creative learning helps students develop self-reliance and independence; it assists students in dealing with future problems that cannot be anticipated; it often leads to powerful life and career consequences; and, it is frequently a source of great joy and personal satisfaction" (p. 22). Treffinger has also summarized three arguments which have been advanced for the inclusion of creativity data in screening and identification procedures in gifted education: (1) the concern about the limitations of the traditional intelligence/IQ measures as indicators of giftedness, (2) the definition of creativity as only one aspect of giftedness or talent, and (3) the need to assess creativity as an aspect of characteristics of most gifted individuals that must be taken into account in enriching the school program - that is, the curricular emphasis in programs for all gifted and talented students (p. 22). It should be reiterated, at this time that, although the discussion of creativity in an educational context is associated with literature on "gifted and talented education", there are many implications for the general student population and especially for the many "exceptional" students not involved in programs for the gifted and talented. Milgram (1984) has pointed out that:

> Society requires many different kinds of talents. Not _all_ of the required abilities are measured in conventional intelligence tests or are associated with outstanding academic achievement. Some highly desirable nonintellective abilities are represented by those nonacademic talented accomplishments referred to ... 'as creative activitiy' " (p. 38).

In order to address the needs of this population, we cannot avoid the need to provide some level of identification. A major distinction called for in the identification process is some demonstration of a difference between cognitive ability as measured by intelligence and/or academic achievment tests and creative ability.

To summarize the discussion thus far, the study of creativity has occurred primarily within the context of research on gifted and talented individuals. The development originated from earlier studies of 'genius' emphasizing intellectual ability as measured by IQ tests and outstanding academic achievement, and has progressed to the current 'multidimensional' approach of using several measures of creativity such as divergent thinking tests as well as other sources of information such as self-reports and the rating of products or behavior as creative.

Assessment of Creative Ability

1. Intelligence-Creativity Distinction

Given the complexity of defining creativity as an operational construct, it follows that the assessment of creative ability is laden with the same problems. It has been pointed out above that the impetus for the more recent research on creativity arose from a changed view of the construct of intelligence sparked by Guilford's structure-of-intellect model: moving from a unitary construct, as represented by the IQ, to a multi-dimensional construct, considering such processes as convergent and divergent thinking. Guilford (1957) distinguishes between convergent and divergent cognitive operations as follows:

> In view of the active nature of creative performances, the production aspects or steps are most conspicuous and probably most crucial. Among the productive-thinking abilities another logical distinction appears. Wtih some productive thinking factors and the tests that measure them, thinking must at some time converge toward one right answer; the significant type of thinking involved has been called "convergent" thinking. With other productive thinking factors and their tests, thinking need not come out with a unique answer; in fact, going off in different directions contributes to a better score in such tests. This type of thinking and these factors come under the heading of "divergent" thinking. It is

in divergent thinking that we find the most obvious indications of creativity (pp. 111-112).

The literature dealing with the limitations of IQ tests as a unitary criterion or predictor of intelligence, especially in the identification of gifted and talented students, provides a notable basis for the intelligence-creativity controversy. Wallach (1985) has addressed the limitations of IQ testing in the identification of gifted individuals suggesting that these tests offer limited information and therefore, should not be used as the primary criterion in defining giftedness. For Wallach, "To call a person gifted or talented, seems, in common sense terms, to refer to that person's unusual accomplishments at something meaningful in its own right - biology or music, sculpture or creative writing" (p. 99). Wallach has referred to other definitions generally supporting this view (e.g. Feldman, 1982; Read, 1962; Whitmore, 1981). He has pointed out that there is considerable research support for the notion that, from the middle to the upper end of their range, IQ scores are not good predictors of giftedness (p. 100).

The classic work on creativity and intelligence by Getzels and Jackson (1962) raised the concern that items on the typical intelligence test seemed to represent a narrow band of intellectual tasks relying mainly on convergent thinking and neglecting those tasks requiring divergent thinking. They stated, "To do well on the typical intelligence test, the subject must be able to recall and to recognize, perhaps even to solve; he need not necessarily be able to invent or innovate" (p. 2). Getzels and Jackson went on to point out that many children who were very high in intelligence as measured by IQ were rarely concomitantly high in other intellectual functions such as creativity with the converse also being true. They held that most of the studies of giftedness were based on the assumption that intelligence and creativity were so highly correlated that the highly intelligent student was also the highly creative student (p. 3). In part, they sought to investigate whether this assumption was tenable. Five measures of "creative potential" were developed to be used with an experimental population of 449 students in Grades 6 to 12 (245 boys; 204 girls). Intellectual ability was measured by available IQ scores from group and individual intelligence tests. The mean IQ of the school population was 132 with a standard deviation of 15. Getzels and Jackson were able to distinguish two groups for comparison: (1) High Intelligence - the top 20% on IQ (mean=150) but below the top 20% on a creativity index and, (2) High Creative - the top 20% on creativity but below the top 20% on IQ (mean=127). There was relatively no difference between the two groups on scholastic achievement. Correlations from .12 to .39 between the divergent thinking tests and the IQ measures were found. According to Getzels and Jackson, this signified that a certain amount of intelligence is required for creativity, but that intelligence and creativity are by no means synonymous.

Other research has born out a moderate relationship between creativity and intelligence. For example, a comparison between scores on the Torrance Tests of Creative Thinking (TTCT) and scores on a variety of group and individual intelligence tests typically fell between .15 and .40 (Wallach, 1970; Yamamoto, 1965). Wallach and Kogan (1965) obtained relatively lower correlation coefficents between the scores on ten creativity and ten intelligence measures ranging between a low of -.13 to a high of .23. One distinction that Wallach and Kogan make between their results and those of other studies, is that their creativity indices were quite highly related among themselves as were the ten intelligence measures but not correlated highly one with the other (p. 48). They observed, in contrast, that the Getzels and Jackson results, for example, showed the five creativity tasks to be virtually no more strongly correlated among themselves than they were correlated with intelligence (p. 287). They noted similar results with other research reports (Torrance 1962, 1963; Torrance and Gowan, 1963; Guilford and Christensen, 1956; Cline, Richards, and Needham, 1963) and concluded that the creativity indicators measured nothing in common that was distinct from general intelligence (p. 288). Wallach and Kogan also raised the question, especially with Getzels and Jackson's creativity measures, of using a composite index of creativity when the subtests appeared to be totally independent measures of different things (p. 5). It is evident, therefore, that research directed at the intelligence-creativity distinction is faced with the problem of selecting measures of creativity which are internally reliable and which also possess discriminant validity when correlated with established measures of intelligence.

Milgram (1984) reports that, in Israel, she and her associates have conducted a number of studies about the relationship of intelligence and creativity (Milgram, 1983; Milgram and Feingold, 1977; Milgram and Milgram, 1976a&b; Milgram, Milgram, Rosenbloom and Rabkin, 1978). Milgram states that:

> In all of these studies, the findings have confirmed the intelligence-creativity distinction across a wide range, and have extended the findings by demonstrating the independence of scores on tests of creativity and intelligence in children and adolescents differing widely in intelligence level, social class, and cultural background (p. 28).

2. Academic Achievment and Creativity

The literature reviewed has not revealed studies based on a comparison of creativity and academic achievement exclusively. Rather, the approach has been to acknowledge the established strong relationship between measures of intelligence and academic achievement and, subsequently, to compare measures of creativity to both. Generally, research supports the notion of an orthogonal relationship between intelligence and achievement. That is, we can predict one from the other: as IQ increases, so do academic achievment scores. This relationshiop does not appear to hold for comparisons between measures of intelligence or academic achievement and measures of creativity, especially divergent thinking tasks. The practice, in some research, of using measures of intelligence and scholastic achievement synonymously confounds the interpretation of results which are usually discussed as intelligence-creativity distinctions.

Wallach and Kogan (1965) used the Sequential Tests of Educational Progress (STEP) as part of their general intelligence battery. They defended their inclusion of the STEP in this context as follows:

> Our inclusion of "scholastic achievement" indicators within the overall category of "general intelligence" reflected the fact that typical indicators of aptitude or intelligence, on the one hand, and of academic achievement, on the other, have been found to be rather strongly correlated. Given these circumstances, the variance shared by aptitude and achievment tests seems to be most appropriately described within the generic psychological label of "general intelligence" (p. 38).

Wallach and Wing (1969) found that academic achievement was predictable from IQ scores. However, this was not the case for achievement on a range of talented accomplishments outside the classroom. Renzulli (1986), in discussing task commitment as one of his three concepts of giftedness, referred to the extensive reviews of research carried out by Nicholls (1972) and McCurdy (1960) which consistently conclude, in part, that "...academic ability (as traditionally measured by tests or grade point averages) showed limited relationships to creative-productive accomplishments" (p. 71).

McKinney and Forman (1977), in looking at the factor structure of the Wallach-Kogan Tests of Creativity and measures of intelligence and achievment, found that the two creativity factors identified: verbal and figural, were independent of factors defined by the intelligence and achievement measures. The average correlation of the Wallach-Kogan subtests was .15 with the composite score on three subtests of the Iowa Tests of Basic Skills and .24 with the Primary Mental Abilities Test full scale IQ. From the total analysis, which used the principle components method of factor analysis, the authors reported support for the conclusion that creativity, as measured by the Wallach-Kogan tests, involved abilities independent of those measured by traditional intelligence and achievement tests.

Milgram and Milgram (1976b) found self-reported creative activity to be related to creative thinking, but not to intelligence or school grades. That is, students reporting high creative performance were characterized by a higher level of critical thinking but not by higher intelligence or school grades (p. 258). As mentioned in the previous section, Getzels and Jackson (1962) reported that their high IQ/low creativity and high creativity/low IQ groups received equally high scores on standardized achievement tests, and this was despite a strong preference for the high-IQ type student reported by teachers.

Milgram (1984) refers to the fact that "...discussion on the Getzels and Jackson study in the literature has focussed on their claim that creativity tests predict academic achievement as effectively as intelligence tests". However, Milgram also states that "...it has been suggested that the high mean-IQ (127) of the group (designated as low/IQ) and not their creativity scores explain these high achievment test scores" (p. 28). That is, comparing two groups with IQ's over 120 would more than likely yield concomitant high academic achievement scores regardless of the groups' creativity levels. Runco and Albert (1986), as part of their investigation of the relationship between creativity and intelligence, calculated correlations between measures of divergent thinking test scores and IQs within four IQ levels. The results indicated nonsignificant correlations between creativity and IQ. Correlations between DT test scores and achievement were calculated for four CAT quartile groups. Results indicated significant correlations for the high achievement group (4th Quartile). When creativity and achievement were correlated within IQ levels, the coefficients were higher and significant in the high IQ group. Runco and Albert stated "... we believe that academic achievement and IQ relate to creativity in significantly different ways, and that the distinction between them is a crucial one" (p. 217).

In summary, the relationship of creativity to academic achievement in the research literature has generally been reported as part of the creativity-intelligence distinction. That is, based on the traditionally high correlations between intelligence and academic achievement measures, creativity measures have been compared to the latter measures concurrently or, in some studies, interchangeably. Achievement measures have been reported through standardized achievement battery scores and through school grades, often expressed as grade-point averages or grade ranking scores. In several studies, intelligence and academic achievment have correlated significantly with one another but not with creativity measures, especially at higher levels of IQ and/or academic achievment, reflecting support for the "threshold theory" of the intelligence-creativity distinction, but not without contradictory research. For example, the recent study by Runco and Albert (1986) has put forth some important questions pertaining to the "threshold theory", which will be discussed below.

3. Threshold Theory

The "threshold theory" puts forth the notion that creativity and intelligence are related only up to an IQ of approximately 120. That is, beyond this threshold IQ score, creative ability, often measured with divergent thinking tests, becomes relatively independent of intellectual ability. Davis and Rimm (1985) have summarized it as follows:

> Over the wide range of intelligence, from mental deficiency to genius levels, there certainly is a moderately good relationship between creativity and IQ scores. However, at high levels of intelligence - namely above a threshold IQ score of about 120 - there is no relationship at all. That is, above this intelligence level, neither a person's IQ score nor school grades will predict his or her level of creativeness (pp. 211-212).

In additon, Runco and Albert (1986) state:

> This theory predicts that measures of intelligence and creativity are related, but only up to a moderate level of intelligence (e.g., Albert & Elliot, 1973; Anderson,1960; Barron, 1969; MacKinnon, 1962; Torrance, 1962). Barron and Torrance have been relatively precise in their estimate of the cutoff: IQ of 120. Above that, intelligence and creativity are ostensibly independent ... the argument is that a moderate level of intelligence is necessary for an individual to recognize that a meaningful problem exists, to select and integrate the relevant information, and to generate an applicable and perhaps original solution (p. 213).

It would appear, according to this body of research, that above a certain level of intelligence, tests of creativity (e.g., divergent thinking tests - especially measures of ideational fluency) are measuring abilities not measured by traditional tests of intellectual ability.

In earlier research supportive of the threshold theory (Albert & Elliott, 1973; Anderson, 1960; Barron, 1969; MacKinnon, 1962; Torrance, 1962; Wallach & Kogan, 1965), creative ability has been, for the most part, assessed with various tests of divergent thinking (DT); intellectual ability, however, has been measured with IQ tests, achievement tests, or tests of specific cognitive ability such as the Concepts

Mastery Test (Terman, 1956). Barron and Harrington (1981), in their extensive review of the literature on creativity, intelligence and personality, reported that very little empirical work had systematically investigated the threshold theory at that time.

Runco and Albert (1986) have recently investigated the efficacy of the threshold of intelligence with a heterogeneous sample of 228 children, grades 6 to 8, who were designated as "gifted" (IQ's 130+ and teacher ratings) and "non-gifted", (IQ<130 and teacher ratings). Correlations between measures of creativity (Wallach-Kogan divergent thinking tests) and intelligence (Stanford-Binet or WISC-R) were calculated within four levels of IQ, and within California Achievement Test (CAT) quartiles. Results indicated very little relationship between intelligence and creativity based on IQ scores. In contrast, a strong relationship between "intelligence" and creativity was obtained when the CAT scores were used. Additionally, the coefficients were large and significant in the high ability groups (IQ>145 and CAT quartile 4). These results were interpreted as refuting the threshold theory in that higher and perhaps significant correlations with creativity in the three lower IQ groups and lower correlations in the top IQ and CAT quartile groups would have been expected to support the theory. They conclude, therefore, that the relationship between intelligence and creativity is very much a function of the particular measures employed and the heterogeneity of the subjects sampled. They point out, however, that many investigations of the threshold theory have contradictory and inconclusive results: in support of the theory (Guilford and Christensen, 1973; Guilford and Hoepfner, 1966; Richards, 1976; and Schubert, 1973) and with contrary findings (Chauncey & Hilton, 1965; Mednick & Andrews, 1967; Ripple & May, 1962; Runco & Pezdek, 1984; Runco & Albert, 1985; Stanley, 1977; Yamamoto, 1965). They explain that this may be due to the different measures of intelligence, different measures of creativity, and highly selective samples being used. It would appear, according to Runco and Albert (1986), that academic achievement and IQ relate to creativity in significantly different ways and that the distinction between them is a crucial one. Academic achievement and IQ should not be used interchangeably as measures of intelligence since they may reflect different underlying cognitive processes (p. 217).

In summary, the threshold theory, which holds that creative thinking ability and intellectual ability are relatively independent at higher levels of intelligence (usually IQ 120+), has been subjected to a notable amount of investigation. As expressed by Runco and Albert(1986), "The popularity of this view is probably due as much to its convincing logic as the empirical support" (p. 213). The amount of research reporting contradictory or inconclusive results regarding this creativity-intelligence distinction certainly raises caution in accepting the theory as an established empirical fact. One of the primary sources of conflicting results was identified as the inconsistency of the methodology with respect to the instruments used in measuring both intelligence and creativity. However, ongoing investigation is warranted, especially in extending it to the relationship of creative activity or performance to intelligence and academic achievement, as reported by Milgram and her associates.

4. Creative Ability and Divergent Thinking

The term "divergent thinking", as previously noted, gained recogniton from Guilford's structure-of-intellect model, in which a distinction is made between these abilities and "convergent thinking" abilities which Guilford identified as the abilities currently measured by traditional tests of intelligence (IQ tests). But, for Guilford, divergent thinking is interactive with convergent thinking as part of the total construct of "intelligence". Creative abilities seem to be concentrated in the operation of "divergent productions" and the product of "transformations". These "abilities" are expressed through the basic traits of thinking with greater fluency, more flexibility, and greater originality, and planning with more elaboration (Guilford, 1981).

Runco (1986a) offers a useful distinction between divergent thinking and creative ability:

> Divergent thinking ability is not equivalent to creative ability, but it is indicative of the potential for creative performance. Hence, evaluating the ideational patterns that are elicited by divergnet thinking tests ostensibly helps researchers understand one component of the creative process (p. 141).

Barron and Harrington (1981) report that their extensive review of the literature reveals more than 70 studies in which positive and statistically significant relationships have apparently been observed between various divergent thinking (DT) test scores and reasonably acceptable nontest indices of creative behavior or achievement. They report validating evidence for DT tests at the elementary school level (Rotter, Langland & Berger, 1971; Schaefer, 1971; Torrance, 1974; Wallbrown & Huelsman, 1975; Wallbrown, Wallbrown & Wherry, 1975); at the junior high school level (Vernon, 1971, 1972), and at the high school level (Anastasi & Schaefer, 1971; Kogan & Pankove, 1972, 1974; Lynch, 1970; Milgram & Milgram, 1976b). However, they make two cautionary points in accepting the validity of DT tests as predictors of abilities involved in creative thinking: (1) DT test scores have often failed to correlate significantly with plausible indices of creative achievement and behavior, and (2) the effect of general intelligence as a factor in the DT validity coefficients reported in many studies has not been determined (pp. 447 - 448). On the first point, the fact that DT test scores often do not correlate with indices of creative achievement and behavior is attributed mainly to the field-specific relevancy and variability of many divergent thinking abilities. Conversely, indices of creative achievement and behavior used as criterion variables have indicated notable variability, as may be observed in the following examples: (a) qualitative measurement of creative products - art, science, etc., Wallbrown & Huelsman (1975) with elementary grade children; (b) "rated creativity of an autobiography", "creativity of a draw-a-man procedure", and "artistic leisure-time interests" with junior high students (Vernon, 1971); (c) self-report on several domains of potentially creative non-academic attainments: creative writing, art, music, sciences, dramatic art, social service, and leadership, with senior high school and college students (Milgram & Milgram, 1976b; Wallach & Wing, 1969), and (d) various biographical accounts of accomplished, eminent persons judged by society as creative individuals: architects (e.g., MacKinnon, 1962), scientists (e.g., Buel, 1965; Roe, 1972), and artists (e.g., Barron, 1972).

On the second point, the undetermined effect of general intelligence as a factor (sharing common variance) on DT scores, it is evident from the research pertaining to the "threshold effect", that DT scores cannot be interpreted unequivocally as indices of creative ability. Barron and Harrington caution against using DT test scores as the sole criterion or operational definition of creative ability on the basis that they appear to be measuring cognitive processes not measured by traditional tests of intelligence (see also Wallach, 1985). Such use of DT tests must be qualified within the context of the specific measures of DT and IQ selected, as well as the particular characteristics of subjects studied (eg. heterogeneous sample, gifted/talented sample).

Notwithstanding the above comments, the relationship between creativity and divergent thinking continues to be a relevant topic of research aimed at a more specific investigation of divergent thinking with respect to the discriminant validity of fluency, originality, and flexibility (eg. Hattie and Rogers, 1986; Milgram, 1983; Milgram and Arad, 1981; Runco, 1985, 1986a, d and e; and Runco and Albert, 1985); the relationship between DT and creative performance (eg. Milgram and Milgram, 1976b; Runco, 1986b and c,1987); and the social validation of DT tests through teacher ratings (Runco, 1984). Several of the above-mentioned studies have also investigated the relationship of DT (creative ability) and creative performance with intelligence and academic achievement.

4.1 Divergent Thinking Tests

Divergent thinking tests have been used extensively , over the past 25 years, to operationalize the construct of creative thinking ability with its subconstruct of ideational fluency. Khatena (1971) addressed some of the problems with the measurement of creative behavior, which provide some background for the following discussion. Referring back to various theoretical models of intellect (Binet, 1909; Vernon, 1950; Wechsler, 1958; and Guilford, 1956), Khatena pointed out that it was Guilford who gave creative mental functioning an appropriate position in his theoretical model and that this unique contribution set the stage for much of the research in the measurement of creative thinking abilities. He referred to Guilford (1959) and Torrance (1962) as having been "...foremost among psychometrists and psychologists who ventured forth to construct suitable instruments to measure divergent thinking..." (p. 74).

Runco (1986b)provides a concise description of divergent thinking tests:

> Divergent thinking can be operationalized as the ability to generate numerous and diverse ideas. It is assessed with tests that contain open-ended questions, and responses from these tests are usually scored for ideational "fluency", "originality", and"flexibility". Divergent thinking is influenced by motivational and situational factors and is of course not completely synonymous with creative ability. Still, divergent thinking tests are psychometrically reliable, and widely employed as estimates of creative potential (p. 375).

The literature reviewed, with respect to the application of divergent thinking tests in the operational definition and assessment of creative thinking ability, revealed the predominant use of two test batteries: the Torrance Tests of Creative Thinking (TTCT) (Torrance, 1966, 1974; Torrance and Ball, 1984), and the divergent thinking (DT) tests of Wallach and Kogan (1965).

An obvious contrast between these two assessment batteries, from a practical point of view, is that the TTCT, although reported in several research studies, is a commercially published instrument and, hence, used extensively in the field of education. The Wallach-Kogan DT tests, on the other hand, remain commercially unpublished as a test, and have been used primarily in research studies, in their original form (Wallach and Kogan, 1965), in the adapted version (Wallach and Wing, 1969) or used in part as an adapted version for specific research purposes.

A second contrast pertains to the theoretical 'underpinnings' of the two instruments. One of the main concerns in the development of DT tests has been the separability of divergent thinking tasks from tasks of convergent thinking typically used in IQ tests. The development of DT tests has taken two approaches. Khatena (1971) provides a good example of this problem:

> In selecting tasks for inclusion in batteries of creative thinking tests, two quite different positions have been taken by Torrance (1966) and Wallach & Kogan (1965). Torrance deliberately selected tasks that tap somewhat different types of functioning. In doing so, he has used both theories about the important differing kinds of functioning that occur in creative behavior and data from factor analyses. In using factor analysis data, he selected tasks that loaded on different factors and eliminated tasks too closely related to one another. Wallach and Kogan, on the other hand, have limited their selection of tasks to those requiring

> association and sought tasks that would yield high intercorrelations with one another (p. 78).

The two approaches, the use of a variety of tasks representing differing functions and the use of closely associated tasks, have raised the question of construct validity. That is, do divergent thinking tasks reflect an extension of abilities presently measured by intelligence tests, which are perceived to contain mainly convergent thinking tasks, or do they represent abilities which are separate and not measured by tasks found on existing IQ tests? A brief discussion of both instruments will serve to further explain these differences.

The TTCT, as mentioned above, has been used extensively by educators in the identification of gifted/talented students and in the implementation of creative thinking programs (cf. Davis and Rimm, 1985, pp. 264 - 265 for summary). The TTCT has also been subjected to research scrutiny in terms of its theoretical basis (e.g. Thorndike, 1972; Treffinger, Renzulli and Feldhusen, 1971), construct validity (e.g. Thorndike, 1972; Wallach, 1972, 1985) and reliability (e.g. Lissitz and Willhoft, 1985).

Treffinger, Renzulli and Feldhusen (1971), in considering the problems of the assessment of creative thinking, have addressed the theoretical nature of the TTCT. They referred to Guilford's structure-of-intellect model as the basis, explaining that the TTCT did not constitute a theory of creativity, per se, but a theory of human intelligence which subsumed some important cognitive aspects of creativitiy. They pointed out that:

> Torrance's (1966) tests purport to be broadly eclectic, drawing from the "best of theory available at the time of their development," but, for that very reason - that they lack a unified, comprehensive, theoretical base - difficulties are inevitable. Of course, the variables assessed by the Torrance Tests (fluency,

flexibility, originality and elaboration) are all *classified in Guilford's structure* of intellect (p. 105).

Torrance (1984) has provided a definition of creativity which reflects the rationale for his selection of differing tasks for the TTCT. He defined creativity as:

> A process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about deficiencies: testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results (p. 8).

In referring to the two batteries of the TTCT, Figural and Verbal Tests A and B, Torrance has avoided acknowledging the source of his scoring categories of fluency, flexibility, originality and elaboration from Guilford's structure-of-intellect model. Rather, he has pointed out that the tests "...represent a sharp departure from the factor type tests developed by Guilford and his associates..." (p. 10). Torrance explains the difference as being one between "product" and "process" - the former referring to Guilford's "products" of divergent thinking; the latter, to his (Torrance's) models of the creative process.

Thorndike (1972), in a review of the TTCT, has lent some support to this view. He stated, "Where Guilford's tests were imbedded in his larger structure of intellect, being primarily measures of various cells in the slab labelled 'divergent thinking', Torrance's tests stand as a single and separate publication" (p. 838).

The separability of divergent thinking tasks from tasks measured by IQ tests has been addressed by Wallach (1972), in a review of the TTCT - 1966 Edition. He stated that:

> Torrance's definition of creative thinking ... is quite close to the traditional conceptions of intelligence including everything, say, that Wechsler's definition of general intelligence includes, with the addition of greater specific emphasis upon hypotheses-search activities in seeking problem solutions. He feels that no convincing empirical separability from intelligence has yet been demonstrated (p. 840).

Referring to his intensive literature review of 1970 pertaining to creativity and intelligence, Wallach (1985) has pointed out that numerous studies have referred to the construct validity of the TTCT with respect to the separability of the TTCT overall scores and scores on tests of intelligence. He observed:

> Because overall scores often were used, even though some scores and tests might have less to do with IQ than others, the distinction between intellective ability and Torrance scores was unclear. Although Torrance himself (1975) seems not to mind leaving intelligence and divergent thinking confounded in his battery, considerable further research moved in the direction of concentrating on ideational fluency as a way to operationalize divergent thinking that was minimally related to IQ in its upper ranges while also yielding substantial correlations among the different kinds of fluency assessments (p. 104).

Discussion of the Wallch-Kogan divergent thinking tests, set within the context of the above discussion of the TTCT, is limited here to a brief examination of the tests' theoretical basis and the issue of the distinction between DT tasks and tasks measured on IQ tests. As one of the measures selected in the research being presented, the Wallach-Kogan DT tests are described and discussed in detail in Chapter III of this research study.

Wallach and Kogan (1965) developed their divergent thinking tasks as part of their large study investigating modes of thinking in young children. The aim of this research was reported as being twofold: first, to determine whether solid evidence could be found that would support the validity of a distinction between intelligence and creativity as modes of cognitive activity. Second, if a distinction between these concepts could be given acceptable empircal support, "... to investigate the possible psychological correlates of individual differences in creativity and intelligence..." (p.1). Two major questions emerging in Wallach and Kogan's study were the question of dimensionality within the creativity domain, and the question of task context; that is, what is measured and in what manner (p. 2). As previously discussed in this chapter, Wallach and Kogan questioned the research being done at that time with respect to the tests being developed to examine the intelligence-creativity distinction.

Their main concern with the creativity measures developed and subsequent research using the tests (Getzels and Jackson, 1962; Cline, Richards and Needham, 1963; Torrance, 1960, 1962; Torrance and Gowan, 1963; Guilford, 1956, 1959, 1963; Guilford and Christensen, 1956) was that, for the most part, the tasks contained on these measures were almost as strongly related to general intelligence indicators as they were among themselves. Wallach and Kogan concluded that, "The measures that have been construed as indicators of creativity are not indicators of some single psychological dimension parallel to and distinct from the dimension of general intelligence defined by conventional intelligence test indicators" (pp. 12 - 13).

Wallach and Kogan based their approach on an "associative" conception of creativity, based primarily on the work of S. A. Mednick (1962) who developed the Remote Associates Test (RAT). Mednick described creative thinking as, "... the forming of associate elements into new combinations which either meet specified requirements or are in some way useful" (p. 221). Wallach and Kogan suggested that, "...if we arrange a situation in such a manner than only appropriate associations are provided by the individuals, greater creativity should be indicated by the ability to produce more associations and to produce more that are unique" (p. 14).

To summarize the associative approach (Wallach and Kogan, 1965), it is first suggested that in associative thinking, common or stereotype responses or ideas are likely to come earlier in a sequence of expressions of a series of associates and that rare or more unique responses are likely to come later, if at all. Second, it is suggested that the individual who can produce a greater number of associates (fluency) will also be the individual who can produce a greater number of unique responses (originality). Finally, the manner in which the associations are elicited is important. It is suggested that "high creativity" is demonstrated by "high production" in terms of both fluency and unique responses. However, sufficient time is required to allow the generation of ideas, and there should be freedom from typical examination pressure or test setting (pp. 17 - 20).

In contrast to the TTCT, the Wallach-Kogan DT tests reduced the tasks to the generation of ideas scored for ideational fluency and originality (uniqueness), omitting the additional indices of flexibility and elaboration. The five tasks developed, three verbal and two figural, were strongly interrelated but weakly related to measures of intelligence. According to the authors, this established discriminant validity or an indication that creativity and intelligence were relatively independent of each other. The administration of the tests was conducted in a gamelike atmosphere without time limits as compared to the more standardized requirements for many of the tasks on the TTCT.

The context in which divergent thinking tests are administered has been widely investigated. Wallach (1985) has summarized studies which have looked at the effect of traditional test-like conditions versus game-like settings, situations considering the factors of time allotment and individual versus group administration of the tests. Although certain studies did support the need for a "non-test-like" context (Wallach and Kogan, 1965; Wallach and Wing, 1969; Boersma and O'Bryan, 1968; Nicholls, 1971), Wallach states that the preponderance of evidence seems to suggest that the context of test administration is irrelevant (Hattie, 1977, 1980; Kogan and Morgan, 1969; Sherwood, 1969; Wallach, 1971; Williams and Fleming, 1969) (pp. 105 - 106).

In summary, divergent thinking tests have dominated the assessment of creative thinking ability since Guilford's development of the structure-of-intellect model. The direction, over the past 25 years, has been a move toward the validation of creative ability as relatively independent from intellectual ability. The research has been operationalized through the development of a variety of tests, mainly based on the concept of divergent thinking, which would quantify or provide a psychometric basis for the elusive construct of creative ability. Two measures, which have been extensively used in research were presented for discussion: the Torrance Tests of Creative Thinking and the Wallach-Kogan divergent thinking tests. Contrasts pertaining to the theoretical bases, structure and nature of the tasks, and research findings have been highlighted.

4.2 The Basis of Ideational Fluency

As expressed on tests of divergent thinking, ideational fluency is the ability to generate numerous ideas in response to open-ended questions which may request: different uses for common objects (alternate uses); how two things are alike (similarities); and listing meanings derived from abstract patterns and line drawings (figural tasks). Fluency refers to the quantity of plausible responses to items generated by an individual. It may also be referred to as "ideational productivity".

The measurement and scoring procedures for ideational fluency varies with the particular test used and the aims of the particular research using this variable. A fluency score constitutes the total number of plausible ideas generated by the individual. Once the total number of responses for a sample of subjects are pooled, it is possible to evaluate them for "originality" which may be ideas that are "unique", that is, submitted by one person only in the sample; or "statistically unusual", for example, ideas submitted by five percent or less of the sample under investigation. Some researchers (e.g. Milgram, 1983) may choose to further evaluate unique or unusual responese as high or low quality based on predetermined criteria and scored by independent judges. Flexibility involves rating the responses according to the number of different categories or classifications which are generated for a given item. The TTCT also has an optional scoring index for "elaboration" which rates the responses on the number of additional details over and above the original task requirement.

Scores for ideational fluency tests are reported as verbal fluency and figural fluency or, if scored additionally for originality, they may be reported as a total fluency score and a total originality (unique/unusual responses) score. Occasionally, as with the TTCT, a total "creative ability" score or index may be reported even though the tasks have been scored for fluency, originality, and flexibility. This practice, however, has raised the concern by some researchers that ideational fluency may confound the derivation of discriminant scores of originality and flexibility. Hocevar (1979a,b) aptly demonstrated the pervasive influence of fluency on originality and flexibility. Using tasks from the Guilford DT tests and the TTCT, he applied partial correlation procedures to determine the convergent validity of the three variables. Although these three indicators of divergent thinking were highly intercorrelated, when fluency was controlled, the convergent validity of originality and flexibility decreased substantially.

The particular influence of fluency on subsequent indices of the quality of responses, reflects the theoretical basis of divergent thinking, and more specifically, fluency, which is embedded in the theory of the creative process as expressed by several theorists (e.g., Guilford, 1956, 1957; Mednick, 1962; Wallach & Kogan, 1965). Milgram (1983) states that "These theorists contend that (a) ideational fluency is a cognitive capacity distinct from intelligence; and (b) the generation of many potential solutions leads to the production of a few that are highly original" (p.619).

Guilford and Mednick, as cited above, have put forth the "associative thinking" notion of creativity which asserts, in addition to (b) above, that quantity of associative ideas leads to quality and originality. There is an order effect in the generation of ideas; that is, ideas emerging at the beginning of a series of associations are likely to be more common or stereotyped, with original ideas emerging toward the end of the series.

Milgram, Milgram, Rosenbloom and Rabkin (1978) investigated the quantity and quality of creative thinking in 6th grade and high school students, using the Wallach and Kogan Creativity Battery (Wallach & Kogan, 1965). They found that quantity and quality of creative thinking were moderately related in both samples and that quantity (fluency) was a necessary condition for the emergence of quality (originality). Milgram (1983) examined the validation of ideational fluency measures of original thinking in children (ages 7-13 yrs.). The findings obtained at all ages, intelligence levels, and SES groups provided impressive support for the construct validity of the Guilford-Mednick conceptualization of original thinking, referred to above. There were consistently high relationships between corresponding scores on "original problem-solving" (criterion) and "ideational fluency" (predictor), and of the quantity-quality scores within these measures. Milgram suggests that these findings provide strong support for the formulation of ideational fluency as a critical cognitive component of the creative process in children (p. 621).

In his investigation of flexibility and originality in children's divergent thinking, Runco (1986 b) confirmed that flexibility and originality scores were higher in the second half of the ideational set and that this order effect was unrelated to the IQ scores of the subjects.

In summary, ideational fluency is held as a critical cognitive component of the creative process, which appears to be distinct from intelligence. In reporting results from tests of divergent thinking, it is suggested that ideational fluency, originality and flexibility scores be reported separately rather than using a total creativity index or score because of the pervasive influence of fluency on quality scores.

4.3. Ideational Fluency as Predictor

Ideational fluency has been investigated as a predictor of different aspects of creative ability and/or performance, for example, original thinking, out-of-school accomplishments, and "real-world" creative performance for specific domains of activity. Milgram and Arad (1981) found ideational fluency to be a predictor of original problem-solving with college students. A subsequent study (Milgram, 1983) discussed in the previous section, provided similar findings with children aged 7-13 years. Wallach and Wing (1969) found ideational fluency measures based on the Wallach-Kogan DT tasks to relate to talented out-of-school accomplishments during high school years, whereas ability test scores showd no such relationships. Milgram and Milgram (1976b) found results similar to those of Wallach and Wing with Israeli students graduating from high school. Hocevar (1980) also found ideational fluency to be related to out-of-school accomplishments; although intelligence was unrelated to fluency, in this case it was related to accomplishments. Despite these positive results, Wallach (1970) points out that "Much of the variation in the criteria of giftedness remains unaccounted for by ideational fluency-type assessment" (p. 107).

The prediction of "real world" attainments from ideational fluency measures has also been found to be "field-specific" rather than general (e.g. Milgram and Milgram, 1976b; Rotter, Langland, and Berger, 1971; Wallach and Wing, 1969). In addition, it has been reported that ideational fluency scores are more valid and reliable as predictors with the "gifted" (i.e. upper range of intelligence - IQ 120+) than with the "non-gifted", which reflects, to some degree, the threshold theory (Guilford, 1967; Mednick, 1962; Runco, 1985, 1986b; Runco and Albert, 1985).

Kogan and Pankove (1972) found ideational fluency at 5th and 10th grade to predict talented out-of-school attainments at 10th grade in one school but not in another. In a follow-up study, considering out-of-school attainments of the same children at the end of high school, Kogan and Pankove (1974) found limited predictability from 5th or 10th grade ideational fluency to those attainments, but found some predictabilily from IQ. Results of a study by Cropley (1972), as reanalyzed by Jordan (1975), indicated no predictability on a 7th grade assessment from either ideational fluency or from IQ to out-of-school attainments examined in the 12th grade. Wallach (1985) concludes that "The evidence regarding connections between ideational fluency and gifted or talented attainments is mixed at best" (p. 108). Wallach cautions against adopting ideational fluency as being synonymous with creative ability. Ideational fluency may be affected by factors other than creative ability; and creative ability is determined from a multi-dimensional source. Runco (1986b) has cited several studies (Albert, 1975, 1980; Albert & Runco, 1986; Nicholls, 1972; Renzulli, 1978) which support the notion that, "Contemporary theories of creative achievement suggest that DT and traditional forms of intelligence do not operate independently in the "real world". Instead, they probably interact" (p. 1247).

In summary, both supportive and contradictory evidence is provided for ideational fluency as a predictor of other aspects of creative ability and performance. The variation between gifted and non-gifted subjects and the finding that prediction of real-word accomplishments from ideational fluency tends to be field-specific, may have contributed, in part, to the inconsistent findings.

Assessment of Creative Performance

Creative performance, for the purpose of this review, refers to those expressions of creativity which relate to the individual's behaviors, activities and products perceived to involve creative talent. Whereas creative thinking ability has been addressed as a cognitive ability akin to but also independent of intelligence and measured with DT tests, creative performance will be addressed as the individual's activities and personal characteristics which are observed by self and signficant others and are perceived to be different from the average and judged to be worthwhile and creative (original, unique, etc.).

1. Use of Self-Report Information

Runco (1986c) discusses the value of using self-report data in the investigation of creative performance. He points out that, although self-report measurement has several inherent problems (e.g., subjects' memory and honesty), it is still a widely used criterion (Bull & Davis, 1980; Hocevar, 1976, 1980; Holland, 1961; Howieson, 1981; Milgram & Milgram, 1976b; Rotter, Langland & Berger, 1971; Runco, 1986a and e; Skager, Schultz & Klein, 1965; Wallach & Wing, 1969). Several virtues are pointed out: "Self-report is ... easily interpreted, has very good psychometric qualities, and is a measure of performance rather than potential" (p.1253). Runco points out that Bull & Davis (1975) and Walkup (1971) have argued in favor of this type of measurement precisely because it is a self-report, for examinees are well informed about their own past performance (p. 1253). Milgram(1983) refers to previous research (Milgram & Milgram, 1976b; Milgram, Yitzak & Milgram, 1977; Milgram & Arad, 1981) in which self-report inventories of hobbies and extra curricular activities have been used as criterion measures of creative performance against standard predictor measures such as DT tests, with resulting strong criterion-predictor relationships (p. 621). Wallach (1985) provides a summary of the use of self-report measures to study the relationship of IQ and out-of-school accomplishments. He comments that self-report, used in most of the studies pertaining to students, has been found to provide acceptable accuracy (e.g., Walberg, 1971; Maxey & Ormsby, 1971; Munday & Davis, 1974; Wallach & Wing, 1969).

2. Use of Teacher Rating Scales

The literature on the identification and selection of students for "gifted and talented" programs generally includes a "teacher nomination" as one of the criteria. At the same time, teacher nomination is not held up as a valid measure of predicting creative potential or even creative performance. The usual perception is that teachers will generally nominate the well-behaved, academically achieving, and conforming student, thus overlooking the precocious, non-conforming, but albeit creative student. This popular belief is sustained in the light of a lack of valid instruments and appropriate inservice training for teachers which would make them aware of the characteristics that obtain in gifted and creative students.

As professionals, and given the appropriate predictive data to apply, teachers can become very competent at identifying these "exceptional" students beyond the usual achievement and ability score data. Teacher nomination procedures often involve a simple request to "choose the ten top students in your class who you feel are gifted or creative". Occasionally, a rating scale or open-ended form may be used as well. Most of these instruments have been constructed on an informal basis and have not been subjected to a validation study. Perhaps the most widely used rating scale is the Scale for Rating Behavioral Characteristics of Superior Students (Renzulli & Hartman, 1971). This rating scale covers ten areas: four general characteristics (Learning, Motivational, Creativity, and Leadership), and six more specific characteristics (Artistic, Musical, Dramatics, Communication-Precision and Expressiveness, and Planning). Certain scales can be selected according to the specific need of the school. This scale tends to be time consuming even though the descriptors are clear and meaningful. There is very little evidence of the use of this scale in validation studies of creative ability. The primary purpose is directed at identifying the "superior" student.

Runco (1984) has approached the development of a teacher rating scale from the standpoint of providing a measure of social validation for DT tests. The Teachers' Evaluation of Student Creativity (TESC) was developed from many items generated by naive student teachers, whose ideas appeared consistent with common theories of the creative personality (Albert, 1983). Runco states: " It appears that student teachers have a reliable prototype of a "creative individual" in much the same way as experts and lay persons have a reliable prototype of "intelligent" (Sternberg, Conway, Ketron & Bernstein, 1981)" (p. 716). Runco provides a definition of social validation:

> The extent to which a traditional objective psychometric evaluation agrees with or predicts the subjective judgement of teacher, parents, supervisors, or" significant others" (Kazdin, 1977; Wolf, 1978). The rationale for social validation is that traditional psychometric assessments supply only one type of information and that additional meaningful information can also be obtained by asking those significant others who actually interact with - and make important decisions about - the indvidual to be tested. ... But briefly, the primary virtue of social validation is the use of criteria important in the real world (p. 711).

In Runco's (1984) study, six teachers were asked to rate the creativity of 240 students, previously categorized as "gifted", "talented", and "nongifted" according to IQ and teacher nomination, through the use of the TESC. The students were administered the Wallach-Kogan DT tasks. Correlational analysis indicated that the "teacher rating" measure was reliable, significantly correlating with the DT tests and negatively correlating with IQ measure. It was concluded that (a) the social validation paradigm is applicable to the assessment of creativity, and (b) divergent thinking tests have social validity in terms of teacher judgments (pp. 714-716).

To summarize, creative performance has been assessed through self-report by individuals and rating scales completed by significant others, both of which provide information on creative activities and characteristics judged as creative behavior. These procedures can logically be extended to evaluation by peers and by parents; however, the literature reviewed did not reveal "social validation" instruments comparable to Runco's TESC for use by these two groups.

Creativity in Adolescents

Milgram (1984) has provided an extensive review of the literature pertaining to creativity in gifted adolescents. This section draws primarily from Milgram's review in addition to reviews by Barron and Harrington (1981) and Wallach (1970, 1985).

Milgram (1984) states that "One aspect of cognitive growth in adolescence which has been largely neglected by all ... is creative or original thinking" (p. 26.). She claims little is known about the cognitive and personal-social characteristics of creative adolescents or about the nature of their creative achievements. Milgram points out that "... as a result of this gap in knowledge, very few high schools are aware of the special educational needs of creative and talented adolescents and fail to provide for them" (pp. 25-26).

Research on creativity in adolescence appears to focus on three areas: (1) creativity as a cognitive process which changes dramatically in adolescence; (2) the personal-social characteristics of creative and talented adolescents, and (3) real-world creative behavior. Milgram's review follows these focal points which also represent, in part, some of the focus of the current study.

1. Cognitive Processes in Creative Adolescents

Milgram states that "Creative behavior in adolescence is relatively constant. High school students who display nonacademic talented accomplishments are likely to continue to develop in the same direction and to demonstrate similar achievements as adults." She notes , therefore, that "Identifying creative abilities and encouraging maximum realization of those abilities in adolescence would seem to merit high priority" (p26). Several studies, using self-report methods have established that creative activity in high school is associated with continuing creative activity in college (Holland & Austin, 1962; Holland & Nichols, 1964; Richards, Holland & Lutz, 1967).

Studies using tests of divergent thinking , and more specifically, ideational fluency, with adolescents, have provided results which support the conceptualization of original thinking and validity of using such measures as predictors of original problem solving in practical life situations (Milgram, 1983; Milgram & Arad, 1981). These two studies, conducted in Israel, discovered a developmental trend in student samples, from grade 6 to grade 12: an increase in the quality but not in the quantity of creative thinking for 12th graders over the 6th graders that occurs some time after grade 8. Milgram (1984) observes that this trend is related to the use of formal operations - an ability described by Piaget as appearing after the age appropriate for Grade 8. She refers to Feldman (1974) who argues that the creative process is best seen within a Piagetian developmental network and that original thinking represents a higher level of cognitive maturity (p. 29). Referring to Getzels and Jackson's (1962) classical study on the relative importance of intelligence and creativity in adolescents, Milgram sees the most pertinent finding of this study to be " ...that scores of creative thinking were a source of information about cognitive capacities in adolescence which are not tapped in conventional tests of intelligence" (p. 28). Finally, Milgram reports that:

> In Israel, Milgram and her associates have conducted a number of studies about the relationship of intelligence and creativity (Milgram, 1983; Milgram & Feingold, 1977; Milgram & Milgram, 1976b; Milgram, Milgram, Rosenbloom & Rabkin, 1978). In all of these studies the findings have confirmed the intelligence-creativity distinction across a wide age range, and have extended the findings by demonstrating the independence of scores on tests of creativity and intelligence in children and adolescents differing widely in intelligence level, social class, and cultural background (p. 28).

2. Personal-Social Characteristics in Creative Adolescents

It would appear that in the research on creativity in adolescence, more attention has been given to the study of cognitive processes than to personality dimensions. Yet, there is evidence that the actual realization of creative potential in the "real world" will depend on many non -intellectual factors which bear on personality and social relationships. Bloom (1985), in his study of talent development in young people, observes that his study has provided strong evidence of the need for a long, interactive process of encouragment, nurturance, education, and training before an individual can attain extreme levels of capability in a particular talent area regardless of his/her individual characteristics or gifts. He feels his research has raised questions about earlier views of special gifts and innate aptitudes as a necessary prerequisite of talent development (p. 3). Bloom defines talent as " ... an unusually high level of demonstrated ability, ahcievement, or skill in some special field of study or interest" (p. 5). Barron and Harrington (1981) and Dellas and Gaier (1970) have provided correlates of creative behavior which obtain in creative adolescents: broad interests; high energy level; automomy; independence of judgment; self-confidence; self-acceptance; individualistic; unconventional; enthusiastic, and idealistic. Two studies: (Parloff & Datta, 1965; Cashdan & Welsh, 1966) indicated that many of the positive personal characteristics found in creative adults are also present in highly creative adolescents. Getzels and Jackson (1962) found that highly creative adolescents valued personal traits which they believed were unconventional. They were not qualities that led to success or were valued by their teachers. Moreover, in responding to questions about their career aspirations, highly creative adolescents were much more likely than high IQ students to make unconventional career choices. These findings indicated that as early as the adolescent years the personality characteristics most frequently found in creative adults were already present (Milgram, 1984, p.33).

3. Real-World Creative Behavior

Milgram (1984) remarks that "creative behavior in adolescence is best exemplified in the hobbies and activities which teenagers do because they want to and not in order to fulfill school requirements or to earn grades or credits" (p. 36). Wallach and Wing (1969) observe that "talented accomplishments outside the classroom possess greater representativeness of real-life functioning or "ecological validity" than the accumulation of a high academic average in school" (p.3). Hoyt (1966) found that college grades possessed surprisingly little relationship to criteria of acccomplishments in various occupations undertaken after completion of schooling. Milgram (1984) reported on a series of pioneering studies of intrinsically motivated non-academic talented accomplishments in adolescence, conducted by Holland, Richards and their associates. The data of their studies consisted of retrospective self-reports completed by thousands of college applicants and broad samples of college students who described their activities during four years of high school. They were asked to report about real-world attainment such as receiving an award for a science project, etc. Milgram states that "In general, one may conclude from these studies that real-world creativity obtains in adolescence" (p. 37).

In summary, the literature has provided important reasons for the study of creative ability in a high school student population. The use of divergent thinking measures and self-report methods have been supported; the investigation of non-academic activities and accomplishments are also well documented as viable approaches in the prediction of real-world accomplishments, and finally, the constancy of creative behavior from adolescence to adulthood supports the importance of investigating creative ability at this age level.

4. Gender Differences in Creative Adolescents

The research practice of applying a statistical procedure to test for gender differences in selected dependent variables is evident in the literature reviewed on intellectual ability and achievement as they relate to creativity. Very few studies, however, have addressed differences between males and females with respect to creative ability or creative performance as a primary purpose. There are worthwhile observations and findings, however, which provide a context for the two hypotheses of the present study pertaining to gender differences.

In their book, The Psychology of Sex Differences, Maccoby and Jacklin (1974) have provided comprehensive summary tables of several studies which have addressed, in part, gender differences in divergent thinking - verbal creativity (21 references) and nonverbal measures of creativity (9 references). They report that on verbal tests of creative ability (e.g. Torrance tests), "...no sex differences are found in the preschool and earliest school years, but from about age 7 girls show an advantage in a majority of studies. On nonverbal measures..., no clear trend toward superiority of either sex can be discerned" (pp. 113 - 114). Maccoby and Jacklin conclude by saying, "In general, ... it may be said that tests of creativity reflect the already documented difference between the sexes in verbal skills; clearly, girls and women are at least as able as boys and men to generate a variety of hypotheses and produce unusual ideas" (p. 114). A few studies pertaining to adolescents are cited as follows: Raina (1969) found that boys 13 - 15 years of age (in India) obtained higher scores than girls on the Torrance Test total verbal score; Fredriksen and Evans (1974) found that 18 year old men obtained higher scores than women on the number of remote consequences generated (Guilford's Consequences test); Abney (1970) found that women aged 18 - 21 years (honors group) performed better than men on the Remote Associations Test (RAT) (Table 3.13, p. 113). On nonverbal measures of creativity, Torrance (1965) found that gifted boys, aged 12 - 13, rated higher than girls on Torrance Test figural scores; Raina (1969) reported the same results with boys 13 - 15 years of age (in India); Mendelsohn and Griswold (1966) found that women aged 18 - 21 years performed better than men on the Barron-Welsh Art Scale of creative potential (Table 3.14, p. 115). Sixteen of the twenty-one studies cited in Maccoby and Jacklin (1974) and listed under verbal creativity indicated no gender differences for subjects aged 2 1/2 to 21 years of age. For studies listed under nonverbal creativity, seven of the nine studies report no gender differences for subjects 3 to 21 years of age.

In several studies, gender differences have been tested on two or more variables; for example, ability, achievement, and creative ability. Wallach and Kogan (1965) found no significant differences between boys and girls aged 10 on 8 out of 10 creative ability measures and on 5 out of 10 intelligence measures. They reported that on their measures of creativity (DT tests) performance for boys and girls was very much alike. Similarly, with respect to intelligence measures, they concluded that the mean performances of the sexes were relatively comparable (p. 56).

Torrance (1967), in his preliminary work on the Minnesota studies of creative behavior, referred to the relationship between IQ and creativity: "The relationships have rather consistently been higher for girls than for boys, for the lower half or lower quarter of the intelligence continuum than for the upper half or quarter, for verbal than for figural measures, and for fluency and elaboration than for originality" (p. 147).

Kogan and Pankove (1972) studied creative ability over a five year span, testing a sample of students in Grade 5 and again in Grade10 on Wallach-Kogan (1965) tasks and IQ. They reported that there was substantial stability in ideational productivity (fluency) and uniqueness scores over the five years for boys, where the creativity tests were group-administered, and for the girls, in the context of individual testing. In addition, they found that creativity and IQ, which were unrelated at fifth grade level, remained unrelated at tenth grade for females, but were positively correlated for males. Milgram (1983), in a validation study of ideational fluency measures of original thinking, found no gender differences on IQ, original thinking, and fluency measures (p. 621).

With respect to creative performance, Hocevar (1976) investigated the dimensionality of creativity. For 239 college students (129 females, 110 males), positive correlations of low to moderate magnitiude were obtained among indices of creativity in fine arts, crafts, performing arts, math, science, literature and music. Males reached more statistical values than females. Females were higher on crafts (p<.001) and performing arts (p<.005); males were higher in math and science (p<.005). Hocevar concluded that the positive relationships among six different areas of creativity suggested a generalized diposition to distribute one's creative efforts across areas (p. 870), presumably for both males and females.

Finally, Milgram and Milgram (1976b) found no differences between genders (high school seniors) on the Wallach-Kogan measures of ideational fluency. However, self-report of creative performance was heterogeneous: young men obtained significant correlations with ideational fluency on writing and social leadership; young women, on fine arts, social leadership, writing and sports.

In summary, this brief review of literature pertaining to gender differences on measures of intelligence, creative ability, and creative performance has indicated few strong trends favoring males or females with respect to intellectual or creative ability.

There are some indicators in creative performance measures, such as self-report, which appear to reflect the domain-specific nature of such measures. There would appear to be an implicit caution in the research in supporting certain overgeneralizations pertaining to gender differences and preferences, especially when investigating selected populations such as the gifted, talented and creative individuals.

CHAPTER III

METHODOLOGY

Introduction

The study was initiated by obtaining written permission from the Superintendent of Schools of the County of Parkland No. 31 to conduct research in the school system (see Appendix A). Permission was granted under three conditions: (1) that the research proposal be approved by a University of Alberta ethics committee, (2) that written parental consent be obtained for any student participating in the study and, (3) that the principal of the school selected for the study give his consent.

Spruce Grove Composite High School was selected for the study. With an enrolment of approximately 1000 students and 55 teachers, this urban-rural high school offers a full range of programs: academic, general diploma, vocational and academic-occupational. The school population comprises students from the City of Spruce Grove, which has two "feeder" junior high schools, and the surrounding rural area with two "feeder" junior high schools. The georaphical area between Spruce Grove and the City of Edmonton is comprised of both farm land and acreage subdivisions inhabited primarily by the urban sprawl population from Edmonton. Hence we have a student population representative of both urban and rural backgrounds and experiences.

Some staff members of this school have demonstrated an interest in the development of program alternatives and opportunities to meet the needs of students from a broader perspective - that is, beyond the academic subject requirements, by addressing students' gifts and talents which include interest areas and community exposure through mentorships. Currently, an assistant principal and three teachers have been working cooperatively with the school system's Program Facilitator (Gifted/Talented) on these initiatives.

Subjects

The eleventh-grade, with an enrolment of 337, excluding four German exchange students, was designated as the population to be investigated. It was decided that Grade 11 students, having completed one year of high school and not facing the pressure of diploma examinations and graduation experienced by Grade 12 students, represented a relatively stable population for the purpose of obtaining background information on creative activities as well as general interests both at school and out of school. The fact that teachers would be rating the students on creative behavior presented the need to select students who would be relatively well-known by the staff, which would not be the case with the incoming Grade 10 students.

Instruments

Four assessment instruments were administered to the students: a test of intellectual ability (Otis & Lennon, 1979), a test of divergent thinking (Wallach & Kogan, 1965; Wallach & Wing, 1969), a checklist of students' creative activities (Runco, 1985), and a brief inventory of students' current extra-curricular activities, interests and career goals, which was attached to the latter. In addition, parents of students in the sample, and selected teachers, representing a cross-section of subjects being taught, completed a rating scale of students' creative characteristics (Runco, 1984).

1. Otis-Lennon School Ability Test (O-LSAT) Advanced, Form B

This group-administered test of intellectual ability was selected as a reputable instrument which could be easily administered within 50 minutes. The time factor was crucial considering the conditions placed by the school regarding the amount of instructional time allotted for the study, namely, two 80 minute blocks.

The Otis-Lennon School Ability Test (O-LSAT), published in 1979, is a revision of the Otis-Lennon Mental Ability Test published in 1967. The concept of ability that underlies the Otis-Lennon tests is presented as "... that of general intellective ability - Spearman's "g" as modified by Vernon (1960)" (Otis & Lennon, 1979, p.4). The tests concentrate on " ... assessing the verbal-educational factor through a variety of tasks that call for the application of several processes to verbal, quantitative, and pictorial content" (p.4). The test is similar to other group tests which purport to assess pupils' intelligence and scholastic aptitude (Oakland, 1985, p. 1111). The purpose of the test is said to " ... provide an accurate and efficient measure of abilities needed to acquire the desired cognitive outcome of formal education" (Otis & Lennon, 1979, p.4).

The O-LSAT-Advanced Level comprises several types of verbal and non-verbal items intended to sample a relatively wide variety of mental processes. Item content samples verbal, figural, and quantitative reasoning, and verbal comprehension ability. There are 80 items arranged in spiral omnibus form to be completed in 40 minutes. A total score is derived which is then converted to a School Ability Index (SAI). In effect, this is a normalized standard score with a mean of 100 and a standard deviation of 16 points. SAIs are provided for three-month intervals of chronological age. It is reported that SAIs have the same statistical characteristics and were developed in the same manner as deviation IQs. It is suggested that the user may choose to use SAIs as DIQs if preferred.

Reviews from the Seventh and Ninth Mental Measurements Yearbook (Buros, 1972; Mitchell,1985) and from Test Critiques (Keyser & Sweetland, 1984), generally recognize adherence of the authors to a high level of current standards in the construction and norming of the test. Reliability coefficients, determined on Kuder-Richardson (K-R 20) and test-retest procedures were found to be very satisfactory.

They are reported for both grade and age levels. For Grade 11 students (N=7,846), an internal consistency (K-R 20) of .93 with a standard error of measurement of 4.1 is reported. For ages 15 to 17, the K-R 20 is .95 with a SE_m range from 3.9 to 3.6. The test-retest reliability over a six-month interval, for the Advanced Level, was .84. The validity data get mixed reviews. For the Advanced Level, Grade 11 (N=165 - 364) the correlations between Fall O-LSAT scores and end-of-year grades in Mathematics, English, and Science were .40, .47 and .46 respectively, as measures of predictive validity. Both concurrent and predictive validity were subsequently investigated through correlations with standardized achivement measures: Metropolitan Achievement Test and Stanford Achievement Test, with validity coefficients ranging between .40 and .60. Criterion-related validity was also tested against scales of intelligence and aptitude measures as follows: .58 with the Stanford-Binet, Form L-M, .85 and .60 to .75 with the Full Scale of the Wechsler Intelligence Scale for Children -Revised (WISC-R), in two independent studies, and .85 to .86 with the Differential Aptitude Test (DAT)(combining Verbal and Numerical Scales), also in two independent studies. The reviewer cautions that " ... the criterion-related validity [from the studies referred to above] is tenuous because of the small, isolated, selective samples, and the varied time beween testing" (C. O. Dyer in Buros, 1972, p.1109).

In summary, most group-administered tests of "cognitive ability" used in school settings contain similar restrictions in measuring intelligence compared to individually administered scales such as the WISC-R and Stanford-Binet. It was decided that the O-LSAT would compare favorably with such tests as the Canadian Cognitive Abilities Test (CCAT) or the Test of Cognitive Skills (TCS), with the added advantage of reduced administration time, a determining factor in this study.

2. Divergent Thinking Tests: Wallach & Kogan (1965).

This test of creative thinking ability, developed by Wallach & Kogan (1965) and adapted for older students by Wallach & Wing (1969), was selected as an instrument which could provide a measure of divergent thinking and, more specifically, ideational fluency with relative ease of administration and scoring for both the size of the sample and age of the subjects in the study. In addition, the use of this instrument in previous research pertaining to the relationship of creative thinking to intelligence and non-academic achievement, provided an empirical basis and a satisfactory match for the present investigation of correlates of creativity in high school students. The Wallach and Kogan Divergent Thinking (DT) Tests consist of four probes: two verbal and two figural, concerned with the measurement of divergent thinking and more specifically, the indices of ideational fluency, and originality, or the number of ideas and uniqueness of ideas respectively. The four tests (two verbal and two figural) are briefly described below and a summary of the instrument is included in Appendix B.

1. Uses: the subject is required to write down as many different uses as possible for three familiar objects.
2. Similarities: the subject is required to write down as many different ways as possible in which three sets of paired objects are alike or the same.
3. Pattern Meanings: the subject is presented with three pattern drawings, one at a time, and required to write down as many different things as possible that each pattern might suggest.
4. Line Meanings: the subject is presented with three line drawings, one at a time, and required to write down as many different things as possible that each line drawing might suggest.

It should be noted that the original 1965 battery had an additionl verbal test - Instances, and the five subtests had four items each.

The battery of four tests may be administered both individually and to groups of students. The tests are scored for ideational fluency - the number of discrete responses generated for each item, and originality - the number of responses which are unique; that is, not given by any other individual in the sample population. Originality may be scored for unusual ideas; that is, responses given by less than 5% of the sample population, in lieu of unique ideas. Milgram & Milgram (1976b) suggest that this method is preferable in that it has yielded a higher internal consistency than the unique responses measure. They also refer to Wallach & Wing (1969) who reported that the unique responses score was less strongly and less consistently associated with nonacademic talented achievement than the unusual ideas score.

In developing this instrument for their original study Wallach and Kogan (1965) used a sample of 151 fifth-grade students. Reliability was evaluated using a Spearman-Brown split-half method for both scoring methods (fluency and uniqueness). They reported a high degree of internal consistency for all measures with all coefficients above .40 and 8 of the 10 coefficients exceeding .80. A second measure of reliability, item-sum correlations for each item on all 10 measures, indicated that all items were making a substantial contribution to the score. All item-sum correlations were .40 or better with the majority .60 or better. Discriminant validity was established through the intercorrelation of the 10 creativity measures (5 subtest scores on 2 scoring methods) with 10 measures of intelligence (WISC - 3 subtests; SCAT & STEP scores). The results revealed that "creativity" and "intelligence" were relatively independent of each other. Only 8 out of 100 intercorrelation coefficients were significant at the .05 level and 10 out of 100 at the .01 level.

Wallach and Wing (1969) adapted the instrument for a sample of 503 college entrants. The battery was reduced to four subtests (as described above) with three rather than four items per subest. Administration was by mail with a generous deadline for return. All items were scored for fluency and uniqueness. As a reliability check, two independent judges scored all the ideational responses in 20 randomly-selected protocols as "unique" and "nonunique". For all data combined, 84% agreement was demonstrated. The internal consistency of the four subtests ranged from .57 to .79 on fluency and .37 to .70 on uniqueness. Correlations between the creativity and intelligence measures (SAT scores) ranged from -.05 to .09. The authors concluded that the results provided a clear replication of the earlier study by Wallach and Kogan (1965). In addition, the subjects were divided into two groups based on the DT scores: "high" and "low" ideational productivity. The results of a self-rating scale on nonacademic accomplishments, administered to these two groups, were tested for significance level. The findings indicated that the DT tests discriminated between "high" and "low" creatives, with "high creatives" demonstrating more nonacademic accomplishments than the "low creatives". A similar comparison with "high" and "low" intelligence samples from the same study population did not yield any significant difference. Hence, the DT tests, especially the index of "ideational fluency", was accepted as having discriminant validity and some predictive validity for nonacadamic talented accomplishments.

Several studies by Roberta Milgram and her associates (Milgram, 1983; Milgram & Arad, 1981; Milgram & Milgram, 1976b; Milgram, Milgram, Rosenbloom, & Rabkin, 1981) have made use of the Wallach & Kogan DT tests adapted from the 1965 study or from Wallach & Wing (1969), with samples of students ranging from 50 to 240, from the third grade to third-year college. The internal consistency (e.g., coefficient alpha, Cronbach, 1970) of all tasks is reported as high, especially for ideational fluency (quantity) scores. One deficiency noted in the literature, is the lack of any "test-retest" reliability information. Construct validity has been demostrated through a consistent independence of DT test results from measures of general intelligence, as well as support for the conceptualization of original thinking put forth by Guilford (1957) and Mednick (1962). That is, there is a consistent relationship between the ability to generate many unusual high quality responses to problems where almost any response qualified (lenient standard) and th[illegible] to produce original solutions to problems where specific criteria constituted a solution (stringent measure). Discriminant validity has also been established by findings demonstrating that (a) stringent as well as lenient solution-standards to original problem solving are equally independent of intelligence measures and, (b) original problem solving can be distinguished from intelligence in children as young as age 7, as low in intelligence as IQ 85, and in both middle and low SES (Milgram, 1983, p. 622).

Studies by Runco (1984, 1985, 1986a-c, 1987) and by Runco and Albert (1985) also support the internal consistency of the Wallach and Kogan DT tests for samples of students ranging from 80 to 240, ages 9 to 14 (grades 5 to 8). Construct validity, insofar as the DT tests appear to be measuring cognitive abilities independently of general intelligence, is also supported. Discriminant validity among the DT indices of fluency, originality and flexibility, however, is weak. Fluency is identified as the underlying factor necessary for the other two indices. The predictive validity of the DT tests for creative performance (e.g., from self-report data) is shown as moderately positive, mainly in the "gifted student" population and limited to certain performance areas (e.g., writing, crafts).

The Wallach-Kogan DT tests and subsequent research conducted using the tests in whole or in part were examined. This instrument was selected for the purpose of the present study for the following reasons: (1) research findings indicating the relative independence of DT tasks from IQ test tasks was attractive in terms of determining whether students could be assessed in the area of creativity with reduced overlapping of abilities reflected by IQ scores and academic achievement scores - in effect, allowing for an investigation of the threshold hypothesis; (2) the tasks on the Wallach-Kogan DT battery appeared less complicated in terms of administration, scoring, and interpretation. Relatively, the scoring of the DT appears to require less subjective judgement than other measures such as the TTCT.

3. Creative Activities Checklist (CAL):

This measure of "creative performance", developed by Runco and Albert (1985), is a self-report checklist administered to students. It contains 65 activities in seven scales or domains: Writing, Music, Crafts, Art, Science, Performing Arts, and Public Presentation. Each domain has at least six items (see copy of instrument, Appendix B). The instrument is similar in content and format to that of Hocevar (1978), Milgram and Milgram (1976) and Wallach and Wing (1969). Runco and Albert adapted their version from Hocevar (1978) so that all of the activities would be appropriate to the age-group studied (fifth- to eight-grade students). The CAL appeared appropriate in obtaining the required information on students' general activities with an emphasis on talent areas. Since the instrument is not published, being used solely for research purposes, a copy of the instrument and permission for its use were obtained from the author.

The use of self-report measures has been covered generally in the previous section on the review of the literature. Focusing on the CAL, more specifically, Runco (1986b and c; 1987) and Runco and Albert (1985) have used this instrument with samples of students ranging from 150 to 240, ages 9 to 14 (grades 5 to 8). Quantity scores were derived from the average rating in each domain and a total score which is an average rating of the seven domain scores. Quality scores were derived from a 10-point rating system developed by Milgram and Milgram (1976b) with 10 points representing a "high quality" activity (i.e., unusual, self-motivated and applied in a noteworthy fashion) and 1 point representing a "low quality" activity (i.e., popular activity requiring little initiative). Reliability of the "quantity" scores was evaluated with "coefficient alpha" (Cronbach, 1970), a measure of internal consistency, and reported as adequate, ranging from .67 to .85. Reliability of the "quality" scores was obtained through inter-rater agreement. Two raters independently judged a randomly selected third of the performance questionnaires and assigned identical categories to 77% of the activities. Runco (1986b) found that the quantity of creative performance was more predictive than the quality. Quantity scores correlated significantly with all three DT indices on the Wallach and Kogan tests in certain domains: writing, crafts, art, and public presentation for the gifted sample only (IQ 130+). The quality scores were unrelated to the DT test scores. Runco (1986c) found that certain areas of extracurricular performance were predictable from fluency, both without and with control of IQ, and that other areas were predictable from IQ.

In testing the generality of creative performance with quantity and quality scores, Runco (1987) found quantity only slightly related to quality, suggesting an empirical distinction between the two: quantity reflecting a generality of performance and quality reflecting a specificity of performance (i.e., specific domain). Runco and Albert (1985) found convergent validity of the CAL quantity scores with the three indices of the Wallach-Kogan DT tests, reporting intercorrelations as follows: fluency, unusual-originality, and unique-originality were .225, .309 and .308 respectively, all $p < .001$.

4. Teachers' Evaluation of Students' Creativity (TESC).

The TESC was developed by Runco (1984) from teachers' conceptions of creativity, as an instrument of social validation used to rate the creativity of gifted, talented and nongifted students. The instrument (see copy, Appendix B) contains 25 items. Twenty of these were taken from the responses of 32 naive student teachers who were asked to (a) give synonym of "creativity", (b) list behaviors observed in intermediate school children considered to be "creative", and (c) list personality traits common to "creative students". Only those items suggested by three or more student teachers were included in the questionnaire. Four of the five remaining items - antonyms of four of the items given, were added to avoid a possible response set. The last item added was the adjective "creative". The items were randomly ordered on the teachers' evaluation form. A total score was calculated by taking a mean of the 21 positively worded items (Runco, 1984, pp.713-714). In the study (Runco, 1984), six teachers rated 240 intermediate school students (grades 5 to 8) on the TESC. A test of reliability, using coefficient alpha, yielded correlations of .96 overall with a range of .91 to .97 for the six teachers. The TESC scores correlated significantly with the fluency and originality indices of the Wallach-Kogan DT tests for three groups of students, gifted, talented, and controls: fluency ($r=.30$, $p<.01$; $r=.21$, $p.<.05$; $r=.28$, $p<.01$, respectively), and originality ($r=.34$, $p<.001$; $r=.28$, $p<.05$; $r=.42$, $p<.001$, respectively), establishing adequate convergent validity. Discriminant validity was evaluated by correlating the TESC and the available IQ scores. The coefficients were negative and nonsignificant for the gifted ($r= -.12$) and the talented ($r= -.14$). The study suggests that, even though the TESC had a very high interitem reliability, an evaluation of inter-rater reliability would also be valuable. There is also a need to evaluate the external validity of the TESC. Runco and Albert (1985) looked at the reliability and validity of ideational originality in the divergent thinking of academically gifted children. The TESC was used as one ot the creativity criterion measures. The internal consistency (coefficient alpha) was .96. Correlations with the Wallach-Kogan DT indices of fluency, unusual-originality and unique-originality were all significant ($r= .210$, .452 and .502, respectively, all $p<.001$) establishing adequate convergent validity.

5. Parents' Evaluation of Students' Creativity (PESC)

The research literature reviewed did not contain any checklist or inventory for use by parents in rating their child on creative ability/performance considered to be appropriate for this study. It was, therefore decided to use the Teachers' Evaluation of Students' Creativity (TESC) (Runco, 1984) with parents, after discussion with and permission of the author. It was felt by the researcher that the content and administration method of the TESC make the instrument appropriate for use with parents. The only adaptation required was in the instructions to the parents (see copy, Appendix B). This use of the TESC was seen as an opportunity to contribute further validation of the instrument through parallel usage with teachers and parents, and its application to a high school student population.

6. Students' Interest Inventory

A brief inventory of demographic information, courses registered for in the 1987-88 school year, employment preferences or career goals, and hobbies/leisure-time activities preferred was developed by the researcher in order to obtain descriptive data on the students. This single page inventory was attached to the front of the Creative Activities Checklist.

Procedures

1. Preliminary Organization

Several steps were required prior to the actual selection of students and collection of data.

1. The logistics of administering the three research instruments (O-LSAT, DT Test, CAL) to a possible 300 Grade 11 students with individually scheduled time-tables was planned with the principal the second week of the school term. The principal preferred the administration of the tests to all students in one location on the same day.

Once the anticipated number of participants was finalized (N=176), the school cafeteria was designated as the location.

2. A date and time was set for the testing sessions.

3. A memo, briefly describing the project and inviting student participation, was distributed to all Grade 11 students through the school (see Appendix A).

4. A memo, describing the project in more detail and soliciting cooperation, was distributed to all teachers of Grade 11 students (see Appendix A).

2. Selection of Students

A letter explaining the research project and requesting signed consent for participation of students in the study was mailed to the parents/guardians of each Grade 11 student in the third week of September, 1987 (see Appendix A). ~~The~~ Parent Evaluation of Student Creativity (PESC), described earlier in this chapter, was included, as well as a self-addressed envelope with prepaid postage. In anticipation of an impending strike of postal workers, an alert notice advising parents to return the consent and completed rating scale to the school with each student, should postal services be curtailed, was inserted in each envelope. A total of 337 envelopes were posted. The postal strike did materialize resulting in a slow-down of returns by the deadline of September 30. A telephone follow-up was conducted during the first two weeks in October which resulted in 176 responses - a 52% return rate. A list of the 176 students was compiled and a roster of participating students was prepared for each teacher involved with these students during the instructional blocks designated for the testing session. There were 139 students present for both testing sessions. A follow-up session was held for 16 students who had missed one of the sessions. A letter was sent to the parents of 19 students who were absent for both sessions, offering an opportunity to participate in a supplementary testing session (see Appendix A). Two students responded to this final request. The sample for the study consisted of 81 boys and 76 girls for a total of 157, representing 47% of the population under investigation. The average chronological age was 16 years 4 months.

3. Collection of Data

3.1 Data from School Records

The following data were obtained from cumulative records and the school administration for students in the selected sample.

a. Demographic data: provincial identification number, name, birthdate, gender, name of parent/guardian, mailing address, and telephone number.

b. Academic achievement: The time alloted to the study by the school did not allow for the administration of a group achievement test. Therefore, it was necessary to rely on existing achievement data from school records. First, records were examined for results of standardized tests. The only consistent results were from the Provincial Achievement Test - Grade 9, Language Arts, June, 1986, available for 151 students, and the Canadian Test of Basic Skills (CTBS)- Grade 8, 1984/85 school year, available for 86 students. The larger number of results available for the Provincial Achievement Test and its more recent administration date determined the selection of this instrument for inclusion in the analysis. Three scores from this instrument were recorded and used in the analysis: (1) the total score (PATOT), (2) the multiple choice score (PAMC), and (3) the written responses score (PAWR). A brief descriptive summary of these scales is found in Appendix B.

A second consideration of academic achievement was school-assigned marks in some of the compulsory or 'core' subjects: English, Mathematics, and Social Studies. It was felt that, for the purpose of the study, teacher-assigned marks would provide data reflecting the reality of school assessment, even though such results may be subjective and less reliable than a standardized achievement measure. The opportunity to compare these marks to intelligence scores and creativity measures was deemed to be a valuable dimension of the study. The variability in subject content and enrolment for English 10/13 and Math 10/13/15 precluded using these marks as single achievement score. Social Studies 10, however, was common to 153 cases and therefore, was used as one of the indices. A grade point average (GPA) of English, Mathematics and Social Studies final marks in Grade 10 (1987) was computed for each student with available results. Grade 10 final marks were selected since the collection of data and test administration was conducted at the beginning of the students' Grade 11 year.

c. Administrative information: The following documents were obtained from the school's general office: (1) a set of students' name and address labels and a separate set for each student's parents, (2) a set of students' individual timetables for Semester1, (3) class lists and, (4) a staff list. This infromation and scores from the tests and rating scales administered were recorded on 4" x 6" index cards to facilitate frequent reference. Students were assigned a "case" indentification number beginning with 001.

3.2 Test Administration and Scoring

The location for test administration was the school cafeteria, a large area with a "split-level" orientation comprised of three levels with a difference of two risers in height. This feature was advantageous in that it afforded a clear vision of all seating positions. Students were seated four or six to a table depending on the size of table. A pencil was provided for each student with spare pencils on hand in case of breakage. The researcher and his assistant administered the tests, facilitated by a P.A. system, and proctored the writing. One of the vice-principals assisted as a monitor in both sessions, which were conducted in the first and fourth (last) instructional blocks on the same day. Each session was 80 minutes in length. The order of test administration was (1) Divergent Thinking (DT) Test , (2) Creative Activities Checklist (CAL), and (3) Otis-Lennon School Ability Test (O-LSAT). The DT and CAL tests had no specified time limits. General instructions for both these instruments were given at the beginning of Session 1 and students were instructed to signify when they had completed the DT test, at which time the CAL would be distributed and students could carry on without interruption. At the conclusion of Session 1, both tests were collected. The CAL was filed alphabetically for easy retrieval in Session 2, after completion of the O-LSAT. The O-LSAT, with a total administration time of 50 minutes., was administered at the beginning of Session 2. Students were also given their partly-completed CAL and were instructed to continue with the "checklist" as soon as they completed the O-LSAT.

It is recognized that the seating arrangement was not optimal and could not provide a total guarantee from communication among students. However, it was perceived by all three proctors that the students' behavior and cooperation during both testing sessions was excellent. Occasional reminders to refrain from talking or glancing around were received with cooperation and no re-occurrence. The offsetting advantage of using one area with both sessions held the same day was that the testing conditions were standard for all students. It also eliminated the discussion of the tests among students which would likely have occurred had the tests been administered to smaller classroom groupings over two or more days.

1. Divergent thinking tests. The Wallach-Kogan DT tests, as adapted by Wallach & Wing (1969), was administered as a measure of "creative thinking ability". There was no set time limit and the majority of students completed the tasks within 60 to 70 minutes. The battery, consisting of four subtests with three items each, was scored for "fluency" and "unusual reponses"

Guidelines suggested by Wallach &Kogan (1965) and Wallach & Wing (1969) were applied (see Appendix B).

The researcher and one assistant worked together in the scoring. All responses generated were recorded (from a total of 12 pages for each student). A lexicon of responses was constructed. There was some collapsing of responses required for individual students in the case of repetitive or duplicate responses. Five fluency scores were then computed: (1) Composite (DT Comp FL), (2) Alternate Uses (DT Uses FL), (3) Pattern Meanings (DT Patt FL), (4) Similarities (DT Sim Fl), and (5) Line Meanings (DT Lines FL). The scoring of unusual responses was based on the rationale and method presented by Milgram & Milgram (1976a), whereby, using the lexicon of responses developed from the fluency scoring, those responses given by 5% or less of the total sample were categorized as "unusual". Based on 157 students, the 5% rate translated into 7.85 or 8 responses. The unusual responses were not rated additionally for "high/low" quality. Results were recorded as five scores, in the same way as the fluency scores.

Scoring 157 tests of 12 pages each, with a frequency of response range between 21 and 181 for fluency and between 3 and 85 for unusual responses, took an inordinate amount of time. Scoring for fluency took an average of 60 minutes per paper (total 157 hours) while an average of 90 minutes per paper (total of 236 hours) was spent scoring unusual responses which yielded a total of 393 hours per person or 786 man hours. The additional time required for the scoring of unusual responses can be attributed to the necessity to scan the entire lexicon of responses for each of twelve items in order to establish the frequency of response categories greater or less than the 5% criterion for unusual quality.

2. Creative Activities Checklist (CAL). The checklist was administered, without modification for high school students, as a measure of "creative performance". There

was no set time limit and the majority of students completed the checklist within 40-50 minutes. This checklist, consisting of 65 items organized in seven domains, was scored for quantity and quality. For the quantity scale, students rated themselves on the frequency of participation in activities presented in seven domains, using a 4-point rating scale. Results were recorded as seven domain scores and an average total score: Composite, Writing, Music, Crafts, Art, Science, Performing Arts, Public Presentation; . The scoring process, conducted by a research assistant, involved approximately 50 hours for the 157 checklists. For the "quality scale", a 10-point rating system initiated by Milgram & Milgram (1976b) and further developed by Runco (1987) (see Appendix B), was applied to rate the written responses pertaining to each student's "most creative activity" in each domain. (example in Appendix B). The researcher rated all written responses using the rating system guidelines. This process involved approximately 11 hours. A similar rating was conducted by two independent raters on 30 (20%) randomly-selected cases to establish interrater reliability. Both raters were teachers with B.Ed. degrees, one teacher with 17 years experience and the other with 3 years experience. Both raters had previous knowledge and some interest and experience in "gifted/talented" education. A table of random numbers (Witte, 1980, p. 309) was used in selecting the sample. The raters were instructed on the use of the rating system and familiarized with the CAL. Correlations of the results of the two raters and of each rater with the researcher's ratings were computed and reported as an interrater coefficient of reliability (see Chapter IV, p. 79).

3. Otis-Lennon School Ability Test (O-LSAT)-Advanced, Form R. The test was administered in accordance with the directions provided in the administrator's manual. Responses were recorded on separate NCS Answer Sheets for subsequent optical scoring. Deviation IQs (DIQs) were computed by hand using the appropriate tables from the manual, and recorded for further analysis.

4. Teachers' Evaluation of Students' Creativity (TESC). The principal reserved the right to select the teachers who would be requested to complete the TESC and to set the limit on the number of students a teacher would rate. The rationale given was that teachers in the 'core' subjects such as English, Mathematics and Social Studies could be over-burdened with having to rate a large number of students which could produce a negative effect toward participation and thereby affect their performance on the task. The ratings were distributed among 32 teachers with a majority assigned to teachers of English and Social Studies. Details on the distribution of ratings among teachers is provided in Table C1, Appendix C.

The researcher addressed the school staff at a regular faculty meeting in November for the purpose of explaining the TESC, going over the instructions, and clarifying questions regarding the completion of the instrument. Envelopes containing the appropriate number of ratings, with the students' names filled in, and with the instrucions for completing the instrument attached, were distributed to each participating teacher at the conclusion of the meeting. An attempt to obtain paired ratings on approximately 30 students for the purpose of establishing interrater reliability was not successful. Twelve students were rated by two teachers, not necessarily the same teachers. Even though this was not considered satisfactory for statistical inference, an interrater reliability coefficient was computed and is reported in Chapter IV (see p. 82).

The researcher scored all rating scales and computed an average rating for the 21 positively-stated items. For 157 rating scales, the scoring time was very reasonable, at an average of three minutes per paper for a total of approximately eight hours.

5. Parents' Evaluation of Students' Creativity (PESC). The PESC, one page printed on both sides, was mailed to all parents of Grade 11 students in conjunction with

a letter explaining the nature of the research study, the authorization of the school system and the principal for the researcher to carry out the study, and an appropriate place for signed consent to have their son/daughter participate in the study. Instructions to parents and a copy of the rating scale are found in Appendix B. The researcher scored all rating scales using the same procedure as for the TESC, described above. The time required for scoring the rating scales was basically the same as for the TESC.

Design and Analysis

1. Processing of Data

1. Raw data consisting of student identification number, gender, chronological age in months, and scores on intellectual ability (DIQ), achievement (3 measures), and creativity (4 measures) were processed through the Division of Educational Research Services and the Computing Services Department, University of Alberta.

2. Descriptive statistics of the above-mentioned data were computed for the total sample and by gender.

3. Correlations between all variables, excluding age, and multivariate analysis of variance (MANOVA) for selected variables were computed .

4. In order to create four groups based on intellectual ability, the DIQ scores were first rank ordered, and using the sample mean (DIQ = 112) and standard deviation (13) as criteria, the following groups were formed: Top (IQ 125+, N=29), High Medium (IQ 113 - 124, N=49), Low Medium (IQ 100 - 112, N=55), and Bottom (IQ 77 - 99, N=23).

5. To facilitate the comparison of high and low creatives on each creativity measure with respect to intellectual ability and academic achievement measures, total scores/composite scores on each creativity meaure were rank ordered. For tied scores in the rank order, a random selection of "drawing from a hat" was conducted. Students

with incomplete data on IQ or achievement measures were eliminated resulting in 148 cases. The top and bottom 15 (10%) students for each creativity measure were selected.

6. For the purpose of developing descriptive profiles of Most and Least Creative students, two samples of four students were selected. The Most Creative sample consisted of students who scored among the top 15 (10%) students on four or more of the six creativity measures. There were three such students, one male and two females. Similarly, the Least Creative sample consisted of students who scored among the bottom 15 (10%) students on four or more of the six creativity measures. There were four such students, three males and one female. In order to balance the two groups in terms of numbers, an additional student was selected for the Most Creative sample. This student was selected randomly (ie "drawing from a hat") from among the students who scored in the top 15 on three of the six creativity measures.

2. Analysis

Pearson product-moment correlation coefficients, Cronbach's coefficient alpha, and an interrater reliability procedure were applied to specific creativity measures to test the internal reliability of the instruments (Hypothesis 1).

Pearson product-moment correlation coefficients were computed to test the convergent validity of the creativity measures (Hypothesis 2) and the discriminant validity of the intellectual ability and academic achievement measures (Hypothesis 3.1). Pearson product-moment correlation coefficients were also used to test the discriminant validity of the creativity, intellectual ability and academic achievement measures (Hypothesis 3.2); and to compare measures of creativity and academic achievement within four DIQ groups (Hypotheses 4.1 and 4.2). The rank ordering of the DIQ scores facilitated the grouping procedure.

Multivariate Analyses of Variance (MANOVAS) were computed to test for significant differences between males and females on the measures of intellectual ability, academic achievement, and creativity (Hypotheses 5.1 and 5.2).

The mean DIQ and the means of five academic achievement measures were computed for the high and low groups on each creativity measure and expressed as bar graph profiles (Hypothesis 6). Finally, a descriptive analysis was developed from written responses on a student self-report checklist of creative activities, an interest inventory, and a further interpretation of the measures mentioned above, to illustrate similarities and contrasts between the most and least creative students (Hypothesis 7).

CHAPTER IV

RESULTS

Means, standard deviations and ranges for the ability, achievement, and creativity measures, for gender and for total scores, are reported in Appendix C, Tables C.2 to C.12.

Hypothesis 1

The hypothesis stated that each creativity measure would possess acceptable internal reliability. The analysis and results are as follows:

Divergent Thinking Tests

The four tasks of the Divergent Thinking - Fluency (DT-FL) and Divergent Thinking - Unusual Responses (DT-UN) tests were independently evaluated with coefficient alpha. Results indicate that both tests possess high internal consistency with alpha coefficients of .861 and .804. In addition, Pearson correlation coefficients were computed within the DT-FL and DT-UN tests and between the two tests. Results, reported in Tables 1 and 2 respectively, indicate highly significant correlations (p<.001). It should be noted when interpreting the data from Tables 1 and 2 , that the unusual responses scores (DT-UN) represent a "subset" of the fluency scores (DT-FL); that is, statistically infrequent responses (submitted by 5% or less of subjects) and have not been rated as "quality scores". Hence, there is an "overlapping score" effect noted in the higher scores along the diagonal in Table 2.

Table 1.

Pearson Correlation Coefficients : Intra-correlation of DT Fluency and Unusual Responses Scores for Grade 11 Students (N=157)

	Comp.	Uses	Patt.	Sim.	Line
Comp.		.835	.917	.540	.885
Uses	.865		.656	.396	.585
Patt.	.890	.661		.434	.762
Sim.	.731	.571	.529		.408
Line	.879	.634	.823	.525	

Unusual

Fluency

All values p <.001

Table 2.

Pearson Correlation Coefficients : DT Fluency and Unusual Response Scores for Grade 11 Students (N=157)

	Fluency				
Unusual	Comp.	Uses	Patt.	Sim.	Line
Comp.	.914	.773	.870	.731	.879
Uses	.756	.844	.604	.426	.621
Patt.	.861	.664	.936	.506	.820
Sim.	.509	.416	.422	.564	.387
Line	.784	.544	.750	.454	.921

All values p<.001

Creative Activities Checklist

The seven domains of the Creative Activities Checklist - Quantity Scale (CAL-QT) were evaluated with coefficient alpha. Results indicate the scale to have moderate internal consistency with an alpha coefficient of .70. The seven domains of the CAL-Quality Scale (CAL-QL) were evaluated by correlating the ratings of two independent raters on a random sample of 30 checklists (approximately 20%). Results indicate the scale to be highly reliable with a correlation of .917, p<.001 between the two raters. Correlations of each rater with scores assigned by the researcher were .878 and .870 (both p<.001), a further indication of high reliability. However, a check of interrater percentage of identical agreement on each item was 42%. The percentage of agreement of each rater with the researcher's ratings was 31% and 52% .

Pearson correlation coefficients within the CAL-QT and CAL-QL, as well as between the two scales, were calculated. Results are reported in Tables 3 and 4 respectively. In Table 3, significant correlations (p<.001) of the seven domain scores with the composite score on each scale are indicated. However, intercorrelations of the seven domains show differing results, with the Quantity scale having four non-significant correlations (three involving music) and the Quality Scale having all significant correlations (p<.05 to p<.001). In Table 4, correlations between the total and domain scores of the CAL-QT and CAL-QL indicate differing results. The total or composite scale scores are significantly correlated. However, the domain scores vary. The CAL-QL domain scores are all significantly correlated (p<.001)with the CAL-QT composite score, whereas two CAL-QT domain correlations, Art and Science, are relatively lower (.108, p>.05 and .178, p<.05 respectively).

The intercorrelations of the Quantity and Quality domains indicate some trends. On the Quantity scale, Art and Science have the highest frequency of nonsignificant coefficients and negative coefficients (six out of seven with two negative correlations; five out of seven with one negative correlation respectively). The most highly reliable

Table 3.

Pearson Correlation Coefficients: Intra-correlation of Creative Activities Checklist (CAL) Quantitative and Qualitative Scores for Grade 11 Students (N=157)

	Comp.	Writ.	Mus.	Craft	Art	Sci.	P. Art	P.Pres.
Comp.		.700***	.611***	.648***	.621***	.550***	.671***	.698***
Writ.	.627***		.401***	.366***	.293***	.229 **	.375***	.436***
Mus.	.498***	.262***		.319***	.226 *	.240 **	.328***	.249 **
Craft	.763***	.348***	.133		.274***	.247***	.425***	.379***
Art	.584***	.388***	.007	.471***		.368***	.338***	.257***
Sci.	.426***	.262***	.142	.169*	.173*		.159*	.287***
P. Art	.613***	.248***	.336***	.377***	.170*	.027		.458**
P. Pres.	.734***	.388***	.352***	.409***	.330***	.374***	.432***	

Qual.

Quant.

* p<.05
** p<.01
*** p<.001

Table 4.

Pearson Correlation Coefficients: CAL Quantitative and Qualitative Scores for Grade 11 Students (N=157).

Quant.	Comp.	Writ.	Mus.	Craft	Art	Sci.	P. Art	P.Pres.
Comp.	.455***	.311***	.369***	.239**	.286***	.264***	.298***	.277***
Writ.	.402***	.376***	.230**	.189*	.275***	.270***	.214**	.249**
Mus.	.354***	.249**	.629***	.197*	.044	.069	.199*	.202**
Craft	.304***	.168*	.192*	.155*	.229**	.300**	.201**	.193*
Art	.108	.116	.025	.037	.364***	.088	.010	.108
Sci.	.178*	.067	.041	.129	.035	.403***	-.014	.170*
P. Art	.393***	.273***	.264***	.201**	.180*	.092	.504***	.267***
P. Pres.	.280***	.198**	.181*	.217**	.122	.101	.160*	.264***

* $p <.05$
** $p <.01$
*** $p <.001$

domain is Writing. On the Quality scale, Art and Science also have the higher frequency of nonsignificant coefficients, with four and three out of seven respectively. The most highly reliable Quality domain is Public Presentation.

Parents' Evaluation of Students' Creativity

The Parents' Evaluation of Students' Creativity (PESC) was evaluated with coefficient alpha. Results indicate the scale to possess high internal consistency with an alpha coefficient of .861.

Teachers' Evaluation of Students' Creativity

The Teachers' Evaluation of Students' Creativity (TESC) was evaluated with coefficient alpha. Results indicate the scale to possess high internal consistency with an alpha coefficient of .956. Additionally, an estimate of interrater reliability (see p. 73) yielded a coefficient of .810 .

In summary, results of the above analyses indicate a general acceptance of Hypothesis 1 with some indications of lower internal reliabiltiy for specific domains of the CAL.

Hypothesis 2

The hypothesis stated that the four creativity measures, with their respective subtests, would intercorrelate significantly, demonstrating acceptable convergent validity.

Pearson correlation coefficents were computed between the four creativity measures, that is, the two DT tests (DT-FL and DT-UN), each with four tasks, and the two CAL tests (CAL-QT and CAL-QL), each with seven domains. Results for the total test scores are reported in Table 5 and indicate highly significant ($p<.001$) correlations at low to moderate levels between all measures, based on total test scores. The coefficients,

Table 5

Intercorrelation of Creativity Measures: Total Test Scores for Grade 11 Students (N=157)

	PESC	TESC	DT-FL	DT-UN	CAL-QT	CAL-QL
PESC	- -	.387	.358	.325	.394	.340
TESC		- -	.394	.398	.257	.313
DT-FL			- -	.914	.358	.340
DT-UN				- -	.348	.355
CAL-QT					- -	.455
CAL-QL						- -

All values p<.001

excluding the overlapping score for DT-FL/DT-UN, ranging from .257 to. 455, indicate the common variances shared between the different measures, presumably a common variance of the creativity construct. However, the overlap between any two measures, with the exception of the DT-FL/DT-UN scores, is sufficeintly small to maintain some differentiation between the measures. For example, the common variance shared between DT-FL and CAL-QT ($r=.358$, $r^2=.128$) would be approximately 13%. The fact that all correlations are highly significant confirms the validity of the relationship between these measures not occurring by chance. Results of the intercorrelations of the specific tasks/domains of the DT-FL, DT-UN, CAL-QT and CAL-QL, and the PESC and TESC as well as correlations of these tasks/domains with ability and achievement measures, are reported in Appendix C (Tables C.13 to C.18).

In examining the correlation matrices (Table C.13 and C.14) it is evident that the CAL domains of Art and Science have consistently lower correlations with the DT-FL and DT-UN tasks in comparison to the remaining CAL domains. The CAL-QT domains of Art and Science have 1 significant correlation out of 20 compared to 8 out of 20 significant correlations for the same domains on the CAL-QL. It should be noted that the CAL Art and Science had comparatively lower internal reliability, especially on the Quantity Scale. Generally, Writing, Crafts, and Performing Arts, especially on the Quality Scale, show the strongest correlations with both DT tests.

From a different perspective, looking at the DT tasks, Line Meaning has the most non-significant correlations (12) with the CAL domains, compared with 8 to 9 non-significant correlations for the remaining DT tasks.

DT and CAL

The convergent validity observed among the total test scores does not appear to hold with the intercorrelation of the DT tasks and CAL domains, as evidenced by correlations ranging between -.012 and .377, non-significant to highly significant ($p<.001$). The CAL domains would appear to contribute more to this variability than the

DT tasks. Creative activities such as Art and Science are not significantly related to divergent thinking tasks, whereas Writing, Crafts, and Performing Arts do have a significnat relationship, especially when reported as quality ratings of the students' activities. On the other hand, the DT tasks tend to have a more uniform pattern: approximately the same incidence of non-significant correlations for the four tasks.

PESC and TESC

The highly significant correlation of the PESC with the TESC (r=.387, p<.001) indicates the convergent validity of these two rating scales. Results in Table 5 (p. 83) indicate highly significant correlations of the PESC with all other creativity measures (r=.325 - .387, p<.001) and, on the basis of this study, potential for the PESC as a valid rating scale with parents and in contributing to the social validity of DT tests and self-report instruments such as the CAL.

Results from the TESC, used in this sample of high school students, are also highly significant (r=.257 - .398, p<.001), with somewhat lower coefficients on the CAL scales (r=.257 and .313, p<.001). It should be noted that on this measure, 157 students were rated by 32 different teachers in 9 different subject areas.

In summary, results of the above analyses indicate acceptance of Hypothesis 2, when expressed as total test scores rather than specific task or domain scores. The creativity measures, as expressed by total scores, have acceptable convergent validity. Specific task/domain scores, considered independently may not have equal validity.

Hypothesis 3.1

The hypothesis stated that scores on a measure of intellectual ability, (expressed as deviation IQs (DIQs) will be significantly correlated with selected measures of academic achievement, demonstrating discirminant validity.

Pearson correlation coefficents were computed between the DIQ scores and scores on the five achievement measures. Results, as reported in Table 6, are highly significant (p<.001) with correlations ranging between .419 and .675 indicating convergent validity between the measures and acceptance of Hypothesis 3.1. The intercorrelations of the achievement measures ranged between .409 and .833 and coefficients were generally larger than the correlations with intellectual ability for corresponding measures, demonstrating discriminant validity

Hypothesis 3.2

The hypothesis states that for the total sample, the creativity measures will correlate significantly, but at low to moderate levels with measures of intellectual ability or academic achievement.

Results, as reported in Table 7, indicate significant correlations at low to moderate levels between the creativity and intellectual ability or achievement measures, with the exception of CAL-QT (four non-significnat correlations) and PESC (one non-significant correlation). There is no apparent difference between the correlations of creativity with intellectual ability and with the achievment measures. This would indicate a moderate relationship among the measures with the strongest correlations occurring between the TESC and teacher-assigned marks: S.S. 10 (r=.573, p<.001) and GPA (r=.568, p<.001). The contrast between the Quantity and Quality Scales of the CAL is worth noting, with the latter showing no relationship to intellectual ability or achievement, with the exception of teacher-assigned marks: S.S. 10 (r=.185, p<.05) and GPA (r=.214, p<.01). Compared to the correlations betwen intellectual ability and achievement (see Table 6), the coefficients are slightly lower, ranging from .104 (p>.05) to .573(p<.001). The results warrant acceptance of Hypothesis 3.2 for five of the six creativity measures.

Table 6.

Pearson Correlation Coefficients: Intellectual Ability and Academic Achievement Measures for Grade 11 Students

	OLSAT	PATOT	PAMC	PAWR	SS 10	GPA
N=	156	150	150	150	153	151
OLSAT	--	.633	.675	.419	.509	.532
PATOT		--	.808	.875	.577	.579
PAMC			--	.425	.567	.507
PAWR				--	.409	.456
SS 10					--	.883
GPA						--

All values p< .001

Table 7

Pearson Correlation Coefficients: Intellectual Ability and Academic Achievement with Creativity Measures for Grade 11 students

	N	DT FL	DT UN	CAL QT	CAL QL	PESC	TESC
O-LSAT	156	.408***	.434***	.104	.405***	.133	.392***
PATOT	150	.388***	.355***	.138	.381***	.226**	.346***
PAMC	150	.381***	.364***	.142	.410***	.235**	.381***
PAWR	150	.286***	.247**	.106	.253**	.157*	.219**
SS10	153	.422***	.429***	.185*	.385***	.349***	.573***
GPA	151	.469***	.474***	.214**	.439***	.367***	.568***

* p<.05
** p<.01
*** p<.001

Hypothesis 4.1

The hypothesis, in support of the "threshold theory", states that although correlations between creativity measures and intellectual ability, may be significant in an overall sample, such correlations will be lower and nonsignificant for students in the high ability group (with DIQs of 125 or greater).

Descriptive statistics for the four DIQ groups are depicted in Table 8. Results of the correlations of intellectual ability with the creativity measures, depicted in Table 9, indicate both low negative and low positive correlations with only one significant coefficient ("top" DIQ group on the TESC, r=.370, p<.05). Comparatively, for the total sample, there were four highly significant correlations (TESC = .392, DT-FL = .408, DT-UN = .434, CAL-QL = .405, all p<.001). Although the "top" DIQ group does, indeed, have low and, some negative correlations, there is no discrimination between the four groups based on DIQ. Hence, Hypothesis 4.1 is rejected, or at best, the support is inconclusive.

Hypothesis 4.2

The hypothesis, indirectly related to the threshold theory, states that if intellectual ability and academic achievement are significantly correlated, usually at moderate to high levels, the correlation between creativity measures and academic achievement should also be lower and nonsignificant for students in the top DIQ group.

Pearson correlation coefficients between the creativity and achievement measures within the four DIQ groups and for the total sample are reported in Table 10. A wide variability of coefficients, both in terms of strength and significance distributed among all four groups, is evident. The majority of the stronger and more highly significant correlations occur between two achievement measures (S.S. 10 and GPA) and four creativity measures (PESC, TESC, DT-FL, and DT-UN). The relationships between these measures account for 22 of 32 significant correlations on the total matrix.

Table 8.

Means and Standard Deviations for
Four DIQ Groups of Grade 11 Students

Group	N	DIQ Range	Mean	S.D.
High	29	125-150	131.00	6.45
Mid-High	49	113-124	117.84	3.38
Mid-Low	55	100-112	106.78	3.82
Low	23	77-99	91.70	6.38

Table 9

Pearson Correlation Coefficients: Creativity for Four IQ Groups and Total Sample

Group	N	PESC	TESC	DT FL	DT UN	CAL QT	CAL QL
1	29	-.073	.370*	.340	.327	-.137	-.053
2	49	-.084	.134	-.021	.084	-.093	.026
3	55	.081	.169	.075	.093	-.240	.216
4	23	.024	-.201	.309	.300	-.382	.345
Total	156	.133	.392***	.408***	.434***	.104	.405***

* p <.05
*** p <.0001

Table 10

Pearson Correlation Coefficients: Creativity and Achievement For Four IQ Groups and Total Sample

Group	N	PESC	TESC	DT FL	DT UN	CAL QT	CAL QL
PATOT							
1	29	.213	.203	.350	.427*	.116	.385*
2	48	.077	.195	.176	.061	.044	.100
3	52	.168	.334*	.265	.154	.226	.114
4	22	.271	-.109	.309	.317	-.108	.424
Total	151	.226**	.346***	.388***	.355***	.138	.381
PAMC							
1	29	.169	.238	.248	.288	.069	.196
2	48	.184	.237	.343*	.262	.200	.209
3	52	.119	.258	.067	.032	.203	.143
4	22	.235	.098	.325	.364	-.232	.506*
Total	151	.235**	.381***	.381***	.364***	.142	.381***
PAWR							
1	29	.179	.126	.330	.410*	.124	.412*
2	48	-.010	.116	.014	-.099	-.053	-.012
3	52	.132	.251	.279*	.171	.159	.054
4	22	.213	-.257	.187	.161	.048	.221
Total	151	.157*	.219**	.286***	.247**	.106	.410**
S.S. 10							
1	29	.283	.191	.425*	.388*	.264	.499**
2	49	.329*	.391**	.330*	.332*	.063	.215
3	55	.237	.653***	.154	.204	.157	.168
4	21	.435*	.485*	.410	.356	.080	.297
Total	154	.349***	.387***	.422***	.429***	.185*	.385***

Table 10 continued

GPA							
1	29	.374*	.373*	.497**	.460**	.329	.561**
2	48	.306*	.401**	.320*	.345*	.084	.261
3	54	.265*	.620***	.168	.163	.164	.211
4	21	.470*	.301	.486*	.446*	.022	.240
Total	152	.367***	.568***	.469***	.474***	.214**	439***

* p<.05
** p<.01
*** p<.001

In considering the achievement measures, the Provincial Achievement Test scores (PATOT, PAMC, and PAWR) show a very limited relationship with the creativity measures for students grouped according to intellectual ability (DIQ). On the PATOT, there are significant, low to moderate correlations with the TESC, DT-UN, and CAL-QL tests, but varying among the four groups. The PAMC and PAWR are significantly correlated with DT-UN, but again, within different ability groups. The CAL-QT scale has no significant correlations with the achievement measures. The CAL-QL scale, by contrast, tends to pick up significant correlations with achievement measures within the top and bottom DIQ groups.

In summary, there is no discrimination between achievement and creativity based on ability groupings. Hence, Hypothesis 4.2 is rejected.

Hypothesis 5.1

The hypothesis stated that there would be no significant difference between the mean scores on measures of intellectual ability and academic achievement for males and females.

A one-way multivariate analysis of variance (MANOVA) was conducted with gender as the independent variable and intellectual ability plus five measures of academic achievement as dependent variables. Results, applying Wilk's criterion, indicated a significnant overall gender effect, F (6, 139)=2.29, p<.05. The univariate analyses were then examined and are summarized in Table 11. Two significant differences were found between males and females: on the PATOT (F=6.40, p<.02) and the PAMC (F=5.10, p<.03) with females having the higher mean scores on both tests, which are overlapping scores, with the PA Multiple Choice test contributing 50% of the weight for the PA Total score.

Table 11

Summary of Results of One-Way MANOVA: Gender Differences on Intellectual Ability and Academic Achievement for Grade 11 Students

Independent Variable	DF	Dependent Variables	DF	F Value	Probability (p<.05)	Significant Contrasts
gender*	1	DIQ	145	2.46	.119	None
		Achievement				
		PATOT	145	6.40	.013	2>1
		PAMC	145	5.10	.025	2>1
		PAWR	145	3.54	.062	None
		S. S. 10	145	0.05	.816	None
		GPA	145	1.77	.185	None

Note: * Males =1; females = 2.

1. Due to missing values for some dependent variables, total observations = 146.
2. Females obtained the higher mean scores on all six measures.

In summary, results of the analyses generally warrant the acceptance of Hypothesis 5.1, the one exception being the difference on the achievement measures mentioned above.

Hypothesis 5.2

The hypothesis stated that there would be no significant differences between the mean scores on measures of creativity for males and females.

A one-way multivariate analysis of variance (MANOVA) was conducted with gender as the independent variable and the four creativity measures, including the two scales and respective tasks/domains for the DT test and CAL, as dependent variables. This resulted in a total of 28 dependent variables being analyzed. There was a highly significant overall gender effect, applying Wilk's criterion, F (27, 129)=3.44, p<.001. Results of an examination of the univariate analyses are reported in Tables 12 to1 4.

PESC and TESC

As indicated in Table 12, there were no significant differences in mean scores of the parent and teacher ratings for males and females.

DT Tests and CAL Scales

As indicated in Tables 13 and 14, there were notable significant gender differences in mean scores within the DT and CAL tests (16 out of 28). This warranted further analysis of these measures. Hence, four MANOVAS, providing profile analyses and a test for interaction effects were conducted on DT-FL, DT-UN, CAL-QT, and CAL-QL, inclusive of the respective DT tasks and CAL domains. Males and females were considered as two groups (a two level factor); tasks/domains were assigned as the dependent

Table 12

Summary of Results of One-Way MANOVA: Gender Differences on Parent and Teacher Creativity Ratings for Grade 11 Students

Independent Variable	DF	Dependent Variables	DF	F Value	Probability (p<.05)	Significant Contrasts
gender	1	PESC	156	1.06	304	None
		TESC	156	2.06	.153	None

Note: * Males = 1; females = 2.
Females obtained the higher means on both measures.

Table 13

Summary of Results of One-Way MANOVA: Gender Differences on DT Measures for Grade 11 Students

Independent Variable	DF	Dependent Variable	DF	F Value	Probability (p<.05)	Significant Contrasts
gender*	1	DT Fluency				
		COMP.	156	9.45	.003	2>1
		USES	156	3.75	.055	None
		PATT.	156	9.80	.002	2>1
		SIM.	156	5.13	.025	2>1
		LINE.	156	8.60	.004	2>1
		DT Unusual				
		COMP.	156	4.49	.036	2>1
		USES	156	1.22	.271	None
		PATT.	156	3.27	.073	None
		SIM.	156	0.28	.597	None
		LINE.	156	7.94	.006	2>1

Note: * Males =1; females = 2.
Females obtained the higher mean scores on all measures.

Table 14

Summary of Results of One-Way MANOVA: Gender Differences on Creative Activities Reported by Grade 11 Students

Independent Variable	DF	Dependent Variable	DF	F Value	Probability (p<.05)	Significant Contrasts
gender*	1	CAL Quantity				
		COMP.	156	9.22	.003	2>1
		WRIT.	156	5.86	.017	2>1
		MUS.	156	2.43	.121	None
		CRAFT.	156	9.77	.002	2>1
		ART	156	0.00	.974	None
		SCI.	156	3.08	.081	None**
		P. ART.	156	22.53	.0001	2>1
		P. PRES.	156	1.10	.296	None
		CAL Quality				
		COMP.	156	16.19	.0001	2>1
		WRIT.	156	5.94	.016	2>1
		MUS.	156	2.39	.124	None
		CRAFT.	156	12.18	.0006	2>1
		ART	156	8.76	.0004	2>1
		SCI.	156	0.23	.633	None**
		P. ART	156	25.46	.0001	2>1
		P. PRES.	156	8.06	.005	2>1

** Males =1; females = 2.

* Males obtained a higher mean score than females in Science on both scales, but the differences were not statistically significant.

variables. Results of the statistical tests are provided in Tables 15 to 18 and summarized below:

DT-Fluency (Table 15)

a) The mean scores on all four tasks, for females, were higher than the mean score for males at a moderate level of significance, $F(4, 152)=2.68$, $p<.04$;

b) As indicated on the profile (see Figure 1) there was no interaction between the differences in means on the four variables, $F(3, 153)=.941$, $p=.42$; that is, the profile line segments were generally parallel with females consistently obtaining the higher mean scores;

c) The group means over the four tasks for females was higher than the group mean for males at a highly significant level, $F(1, 155)=9.02$, $p<.003$;

d) A comparison of the differences in means between the four tasks for males and for females indicated a highly significant difference between the two groups., $T^2=25.44$, $F(3, 153)=67.60$, $p<.0001$.

DT-Unusual Responses (Table 16)

a) The mean scores on all four tasks, for females, were higher than the mean scores for males, but there was no significant differences between them, $F(4,152)=2.133$, $p=.08$;

b) As indicated on the profile (see Figure 2), there was ordinal interaction, $F(3,153)=2.858$, $p<.04$; that is, the profile lines were not parallel. There was a smaller mean difference on the Similarities task as compared to the mean differences on the remaining three tasks;

c) The group mean over the four tasks for females was significantly higher than the group mean for males, $F(1, 155)=4.49$, $p<.04$;

Table 15

Summary of Results of Profile Analysis:
DT - Fluency Tasks

Test	Independent Variable	Dependent Variable	T_2	DF 1	DF 2	Overall F	Probability (p<.05)	Significant Contrasts
1. One-Way MANOVA	Group1: Male Group2: Female	DT-FL (4 tasks)	-	4	152	2.68	.033	2>1
2. Parallelism of Profile Line Segments	"	"	-	3	153	0.941	.423	None
3. Equal Mean Profile Effect	"	"	-	1	155	9.019	.003	2>1
4. Equal Variable Effects	"	"	25.44	3	153	67.596	.0001	2>1

FIGURE 1

Profile of Comparative Means on Divergent Thinking Fluency Tasks for Males and Females.

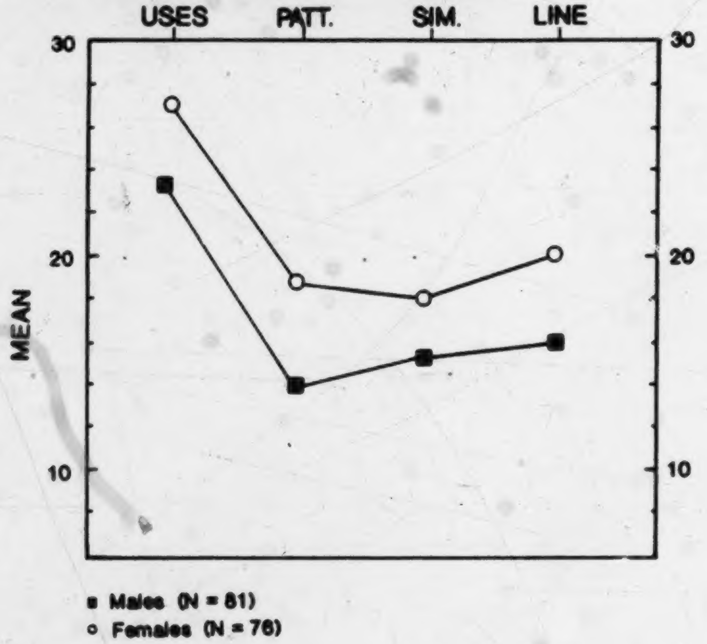


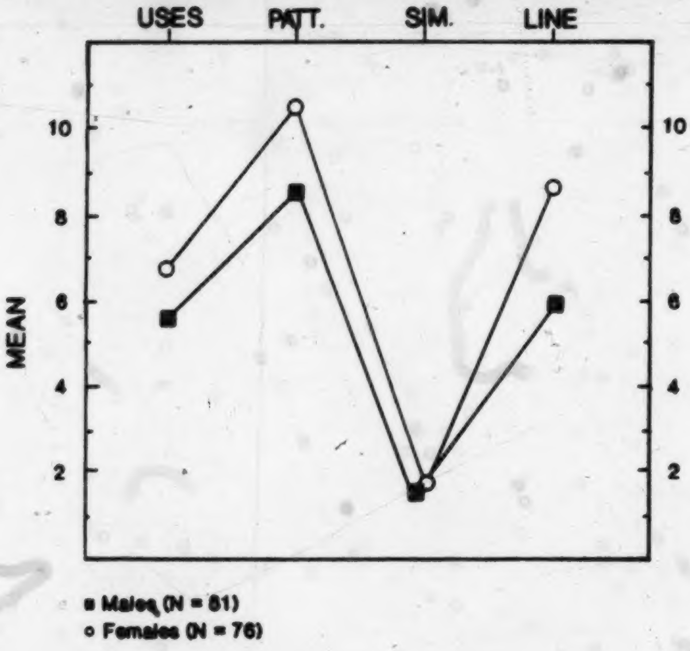
Table 16

Summary of Results of Profile Analysis:
DT-Unusual Responses Tasks

Test	Independent Variable	Dependent Variable	T^2	DF 1	DF 2	Overall F	Probability (p<.05)	Significant Contrasts
1. One-Way MANOVA	Group 1 = Male Group 2 = Female	DT-UN (4 tasks)	-	4	152	2.133	.079	None
2. Parallelism of Profile Line Segements	"	"	-	3	153	2.858	.039	2>1
3. Equal Mean Profile Effects	"	"	-	1	155	4.485	.036	2>1
4. Equal Variable Effects	"	"	279.262	3	153	91.886	.0001	2>1

FIGURE 2

Profile of Comparative Means on Divergent Thinking Unusual Responses Tasks for Males and Females.



d) A comparison of the differences in means between the four tasks for males and for females indicated a highly significant difference between the two groups, $T^2=279.26$, $F(3, 153)=91.89$, $p<.0001$.

CAL-Quantity (Table 17)

a) The mean scores on six of the seven domains, for females, were correspondingly higher than the mean scores for males, at a highly significant level, $F(7,149)=5.61$, $p<.0001$. As previously stated, males obtained a higher mean score in one domain, Science, however, the mean difference was not statistically significant. The mean difference in Art was almost negligible, in favor of females;

b) As indicated on the profile (see Figure 3) there was disordinal interaction, $F(6, 150)=5.38$, $p<.0001$; that is, there was a crossing of profile lines indicative of males obtaining the higher mean score in Science;

c) The group mean over seven domains for females was significantly higher than the group mean for males, $F(1, 155)=6.21$, $p<.02$;

d) A comparison of the differences in means between seven domains for males and females indicates a highly significant difference between the two groups, $T^2=552.88$, $F(6, 150)=89.17$, $p<.0001$.

CAL-Quality (Table 18)

a) The mean scores on six of the seven domains, for females, were correspondingly higher than the mean score for males at a highly significant level, $F(7, 149)=5.16$, $p<.0001$. Males obtained a higher mean score in one domain, Science but the difference was not statistically significant;

b) As indicated on the profile (see Figure 4), there was disordinal interaction, F(6, 150)=3.51, p<.004; that is, there was a crossing of profile lines indicative of males obtaining the higher mean score in Science;

c) The group mean over the seven domains, for females, was higher than the group mean for males at a highly significant level, F(1, 155)=15.90, p<.0001;

d) A comparison of the differences in means between the seven domains for males and females indicated a highly significant difference between the two groups, T^2=69.85, F(6,150)=11.27, p<.0001.

In summary, results of the analyses presented above indicated no significant gender differences on parent and teacher ratings of creative behavior. Accordingly, Hypothesis 5.2 is accepted for these measures of creativity. However, because of the significant differences between males and females on the Divergent Thinking tasks and the the Creative Activities Checklist, Hypothesis 5.2 is rejected for these measures.

Hypothesis 6

The hypothesis stated there would be observable differences between selected "High Creative" and "Low Creative" groups for each creativity measure with respect to average DIQ and academic achievement scores.

To facilitate development of comparative profiles for High and Low Creatives, the top and bottom 15 students (i.e. top and bottom 10%) were selected for each creativity measure based on rank-ordered total scores. Average DIQ and academic achievement measures scores were computed for each group. These data are depicted in Figures 5 to 8 and summarized in Table 19, and in the following observations.

Table 17

Summary of Results of Profile Analysis:
CAL-Quantity of Activities

Test	Independent Variable	Dependent Variable	T^2	DF 1	DF 2	Overall F	Probability ($p<.05$)	Significant Contrasts
1. One-Way MANOVA	Group 1 = Male Group 2 = Female	CAL-QT (7 domains)	-	7	149	5.611	.000	2>1
2. Parallelism of Profile Line Segments	"	"	-	6	150	5.380	.000	2>1
3. Equal Mean Profile Effects	"	"	-	1	155	6.214	.014	2>1
4. Equal Variable Effects	"	"	552.880	6	150	89.174	.000	2>1

FIGURE 3

Profile of Comparative Means on Creative Activities Checklist Quantitative Scale for Males and Females.

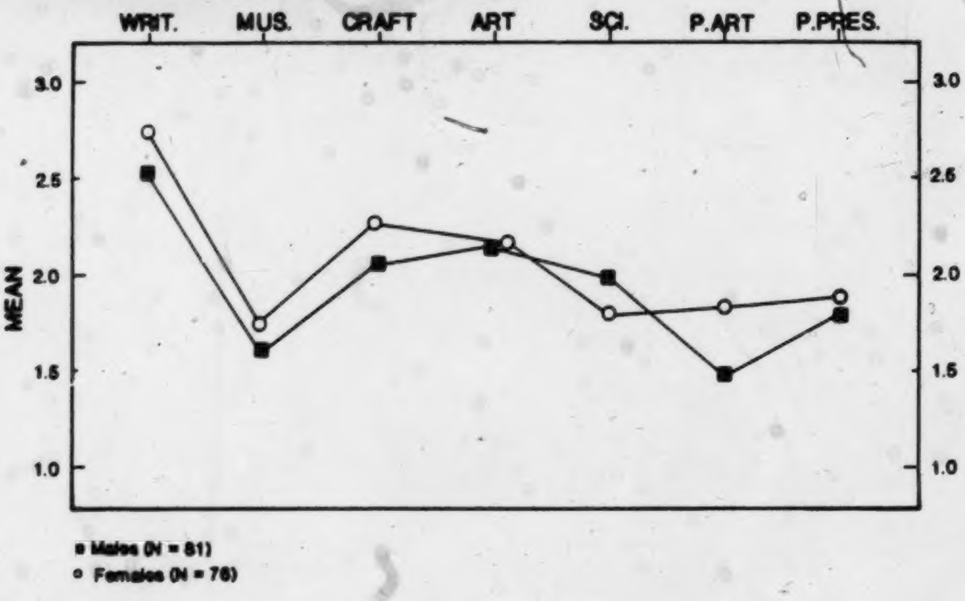


Table 18

Summary of Results of Profile Analysis:
CAL-Quality of Activities

Test	Independent Variable	Dependent Variable	T^2	DF 1	DF 2	Overall F	Probability ($p<.05$)	Significant Contrasts
1. One-Way MANOVA	Group 1 = Male Group 2 = Female	CAL-QL (7 domains)	-	7	149	5.162	.000	2>1
2. Parallelism of Profile Line Segments	"	"	-	6	150	3.512	.003	2>1
3. Equal Mean Profile Effects	"	"	-	1	155	15.904	.000	2>1
4. Equal Variable Effects	"	"	69.850	6	150	11,266	.000	2>1

FIGURE 4

Profile of Comparative Means on Creative Activities Checklist Qualitative Scale

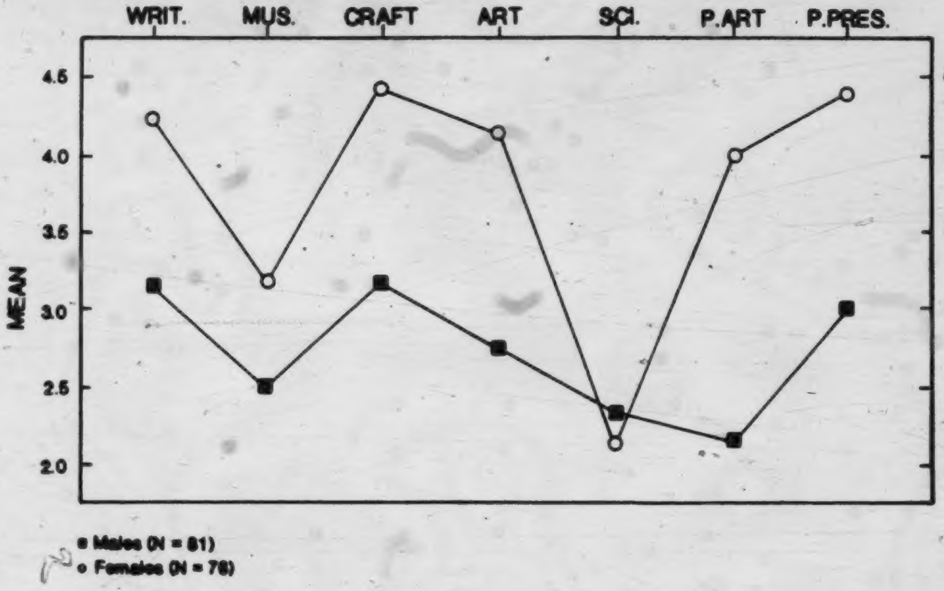


Table 19

Comparative Means of High and Low Creatives on IQ and Achievement

	IQ		PATOT		PAMC		PAWR		S.S.10		GPA	
	H	L	H	L	H	L	H	L	H	L	H	L
N =	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)	(15)
PESC	116.27	108.67	74.67	64.27	3.13	63.40	75.67	64.80	73.27	54.13	68.84	55.76
TESC	125.20	102.80	78.93	59.80	78.07	55.80	79.73	64.27	78.67	49.33	75.40	52.33
DT FL	123.80	106.33	74.20	59.33	75.87	60.53	72.53	54.27	73.60	54.27	70.87	53.20
DT UN	124.93	106.87	76.87	61.47	79.03	53.33	76.00	61.60	75.80	53.87	75.00	53.24
CAL QT	113.40	111.00	69.87	66.93	69.80	64.93	70.67	68.80	68.87	59.47	60.93	58.78
CAL QL	121.53	106.33	76.20	60.93	77.40	59.87	74.93	61.60	71.33	51.80	69.11	50.86

PESC

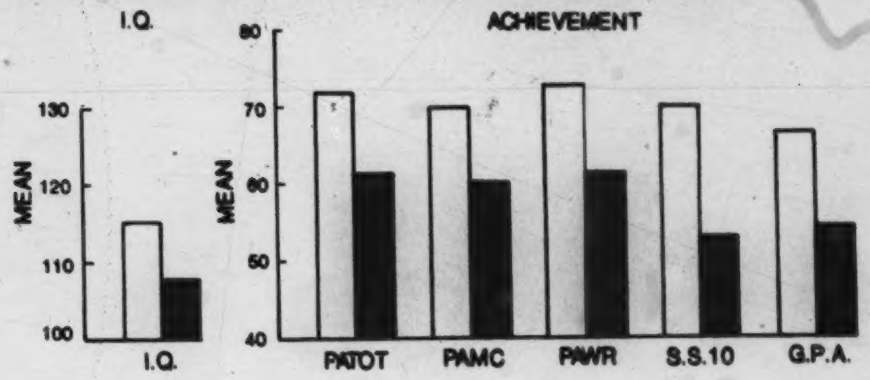
The comparative profile provided in Figure 5, depicts the average IQ and achievement levels for the High and Low Creative students as rated by parents. The range in ability (IQ 108.7 -116.3) was 8 points and the range in achievement (54.1 - 75.7) represented an average spread of 12.6 percentage points over the five measures. The High Creatives fell within the High Average range of intellectual ability and academic achievement. The Low Creatives fell within the Average range of intellectual ability and academic achievement. Parent ratings then, did not indicate a strong association of creative characteristics with intellectual ability and academic achievement. The male/female distribution was fairly even.

TESC

In Figure 6, the comparative profile of High and Low Creatives as rated by teachers, is depicted. The average difference in ability (IQ 102.8 - 125.2) was 22 points, which exceeds one standard deviation for the total sample on the O-LSAT. The achievement marks ranged between 49.33 and 79.73 with an average spread of 21.9 percentage points. The High Creatives, as rated by teachers, fell within the Superior range of intellectual ability with an average IQ of 125.20, and within a high level of academic achievement with an average percentage mark of 78.2 over the five measures. The Low Creatives fell within the Average range of intellectual ability with an average IQ of 102.8, and within an average level of academic achievement with an average percentage mark of 56.3. Teacher ratings of students' creative characteristics indicated a definite association with the relative ability and achievement levels of the students. The male/female distribution was skewed toward females for the High Creative group and males for the Low Creative group.

FIGURE 5

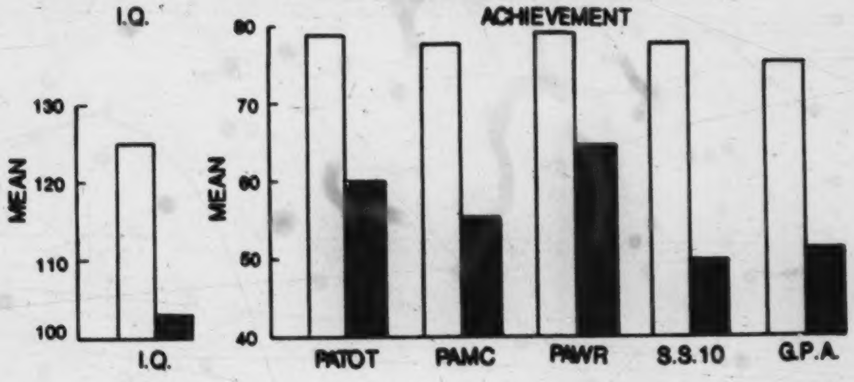
Parents' Evaluation of Students' Creativity: Comparative Means for High and Low Groups on I.Q. and Achievement.



	High □	Low ■
Males =	7	9
Females =	8	6
N =	15	15

FIGURE 6

Teachers' Evaluation of Students' Creativity: Comparative Means for High and Low Groups on I.Q. and Achievement.



	High □	Low ■
Males =	6	13
Females =	9	2
N =	15	15

DT-Fluency Test

The comparative profile provided in Figure 7.1 depicts the average IQ and achievement levels for the High and Low Creatives based on the DT fluency scores. The range in ability (IQ106.3 - 123.6) represented a 17.3 point spread, which exceeded one standard deviation on the O-LSAT for the total sample. The range in achievement (53.2 - 75.9) represented an average spread of 17.1 percentage points over the five measures. The High Creatives fell within the Superior range of intellectual abiltiy with an average IQ of 123.8, and within a high level of academic achievement with an average percentage mark of 73.4. The Low Creatives fell within the Average range of intellectual ability with an average IQ of 106.3, and within an average level of academic achievement, with an average percentage mark of 56.3 over the five measures.

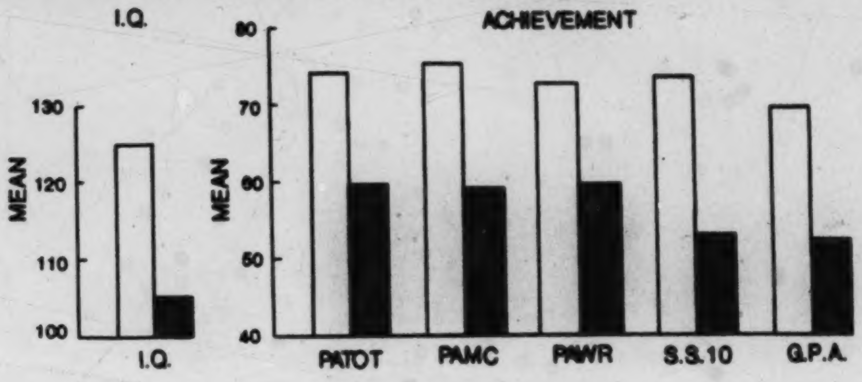
DT-Unusual Responses Test

The comparative profile provided in Figure 7.2 depicts the average IQ and achievement levels for the High and Low Creatives based on DT-Unusual Responses scores. The range in ability (IQ 106.9 - 124.9) represented an 18 point spread, which also exceeded one standard deviation on the O-LSAT for the total sample. The range in achievement (53.2 - 79.0) represented an average spread of 19.9 percentage points over the five measures. The High Creatives fell within the Superior range of intellectual ability with an average IQ of 124.9, and within a high level of academic achievement with an average percentage mark of 76.5. The Low Creatives fell within the Average range of intellectual ability with an average IQ of 106.9 , and within an average level of academic achievement with an average percentage mark of 56.7 over the five measures.

The results of both DT tests were closely comparable. The distribution of males and females was also comparable and skewed toward females for the High Creatives and males for the Low Creatives.

FIGURE 7.1

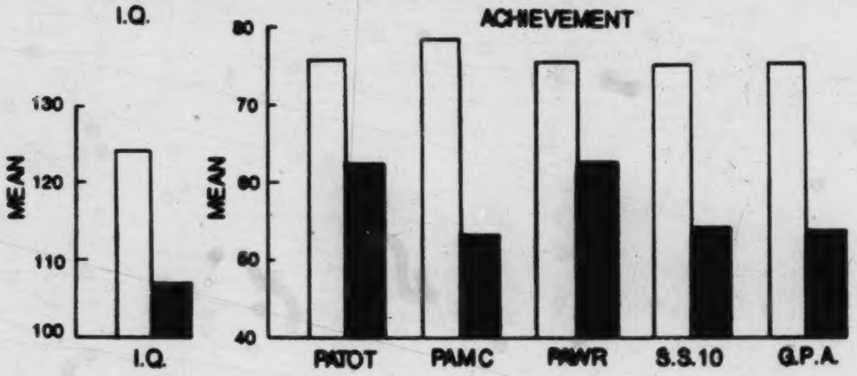
Divergent Thinking Fluency Scale : Comparative Means of High and Low Groups on I.Q. and Achievement.



	High □	Low ■
Males =	4	13
Females =	11	2
N =	15	15

FIGURE 7.2

Divergent Thinking Unusual Responses Scale : Comparative Means for High and Low Groups on I.Q. and Achievement.



	High □	Low ■
Males =	2	11
females =	13	4
N =	15	15

CAL-Quantity Scale

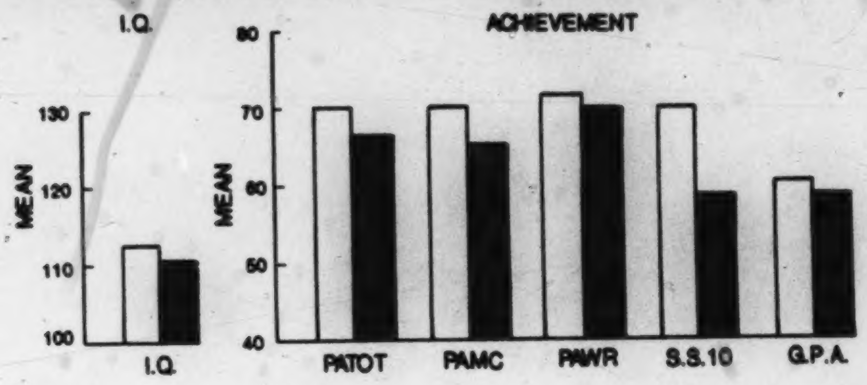
The comparative profile provided in Figure 8.1 depicts the average IQ and achievement levels for the High and Low Creatives based on the CAL-Quantity Scale scores. The range in ability (IQ 111 - 113.4) represented a 2.4 IQ point spread. The range in academic achievement (58.8 - 70.7)represented an average spread of 4.2 percentage points over the five measures. The High Creatives and Low Creatives were both within the Average range og ability (IQ 111 and 113) as well as in achievement level, with average percentage marks of 68 and 63.8 respectively. The CAL-QT scores, then, did not disriminate between students, in terms of intellectual ability and academic achievement. The only noticeable spread was on S.S.10. The male/female distribution was comparable in the High Creative group but skewed toward males in the Low Creative group.

CAL - Quality Scale

The comparative profile provided in Figure 8.2 depicts the average IQ and achievement levels for High and Low Creatives based on the CAL-Quality Scale scores. The range in ability (IQ 106.3 - 121.5) represented a 15.2 IQ point spread. The range in academic achievement (50.9 - 77.4) represented an average spread of 16.8 percentage points over the five measures. The High Creatives fell within the Superior range of ability wtih an average Iq score of 121.5, and within a high level of academic achievement with an average percentage mark of 73.8 over the five measures. The Low Creatives fell within the Average range of ability with an average IQ of 106.3, and within an average level of acadaemic achievment with an average percentage mark of 57 over the five measures. The male/female distribution was skewed in favor of females for the High Creative group and skewed in favor of males in the Low Creative group. These results are more closely comparable to the results obtained on the DT tests than with the CAL-QT scale. Hence, we observe a contrast between the two CAL scales wtih

FIGURE 8.1

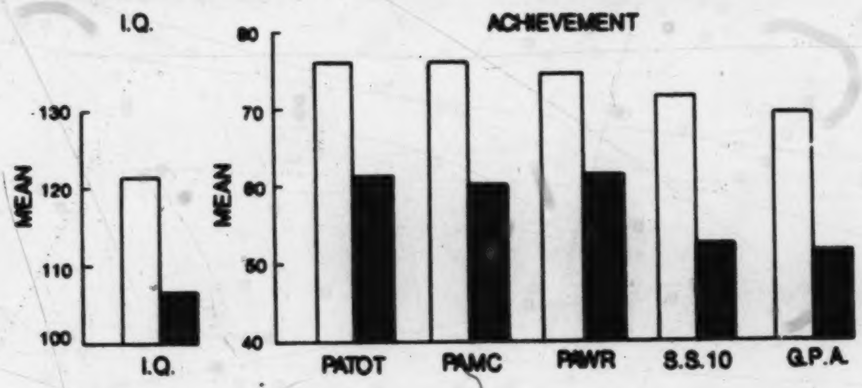
Creative Activities Checklist Quantitative Scale : Comparative Means for High and Low Groups on I.Q. and Achievement.



	High □	Low ■
Males =	7	10
Females =	8	5
N =	15	15

FIGURE 8.2

Creative Activities Checklist Qualitative Scale : Comparative Means for High and Low Groups on I.Q. and Achievement.



	High □	Low ■
Males =	2	12
Females =	13	3
N =	15	15

respect to the discrimination between High and Low Creatives on ability and achievement measures.

In summary, the data presented have indicated sufficient observable differences between the High Creative and Low Creative groups for each creativity measure to warrant acceptance of Hypothesis 6.

Hypothesis 7

The hypothesis stated that both the descriptive and statistical data, in addition to anecdotal data from the interest inventories and CAL, would provide observable similarities and contrasts to develop descriptive profiles for students selected as Most and Least Creative. Procedures for the selection of the Most and Least Creatives are discussed in Chapter III, pp. 77 - 78.

Profiles, developed for each group, are provided in Appendix D. The descriptive data on all members of each group has been combined in order to maintain confidentiality. A summary of each group indicates the following characteristics:

Most Creatives

These students (2 males and 2 females) were characterized by high average to superior intellectual ability which would appear to enhance their development in creative expression as signified by their performance on several creativity measures. Interestingly, their school achievement showed some variability. For example, GPA's, based on teacher-assigned marks, ranged from 67.6% to 84%; Math. 10 from 56 - 90%, and Soc. Studies 10 from 72 - 82%. The Provincial Achievement Test scores ranged from 67 - 95. However, all four students were registered in the academic courses required for the Advance Diploma or university entrance. Courses often associated with creative talent were reflected: Art, Band, Choral Music, and Drama.

However, Psychology, Sociology and practical courses such as Typing and Drafting were also included.

On the creativity measures, the DT test showed the greatest range (88-158 for fluency and 43-72 for unusual responses). Career and employment preferences for all four students reflected a professional field requiring university preparation (eg. psychologist, teacher, professional engineer) as their first choice. Second choices appeared to be related to elective courses taken in school and/or leisure/extra-curricular activities. A total of 17 activities were obtained from the students' Creative Activities Checklists, representing a wide variety of interests and talents (eg. published poetry in newspaper and book, playing musical instruments, participation in student government or church groups, painting and drawing).

Least Creatives

The group of Low Creative students (3 males and one female) were characterized by low to high average intellectual ability (DIQ 88-117) and variability in school achievement: GPAs ranging from 33 - 56%; Eng. 13 from 33 - 67%; Math. 13 from 30 - 67%, and Soc. Studies 10 from 30 - 52%. The Provincial Achievement Test scores ranged from 34 to 65. The student with the highest DIQ did not have the corresponding highest achievement scores nor the highest rating on the creativity measures. Compared to the High Creatives, who were registered primarily in academic courses, and in a total of 14 courses, these students were registered in "23" level courses, pursuing a general diploma program and registered in a total of 19 courses, four of which were at the Grade 10 level. There was an emphasis on practical courses both in the business and vocational routes: Typing, Office Practice, Mechanics, Building Construction. However, other subjects such as Law, Economics, Geography, Psychology and Sociology were also selected. Career choices reflected the trades, business world or service careers such as policeman and fireman. Occasionally, two choices were listed which appeared incompatible or unrealistic, eg. carpenter or lawyer.

These students were not as expressive with respect to listing hobbies or interests. Sports, (eg. hockey, baseball), listening to music and being with friends were frequently listed. A total of five activities, submitted by two students, were provided in the Creative Activities Checklist portion rated for quality. This is contrasted with 17 activities listed by the High Creative group. The Low Creative group's activities emphasized making things rather than organizing or assuming a leadership role as in the High Creative group.

In summary, the data obtained from the sources referred to above, have provided an initial basis from which to develop student profiles reflecting characteristics of the Most and Least Creative students. The results depicted above warrant acceptance of Hypothesis 7.

CHAPTER V

DISCUSSION AND CONCLUSIONS

The results presented in the previous chapter will be discussed in terms of the level of support obtained for each hypothesis, relationship of the findings to the research previously reviewed, and details relatively unique to this study.

Internal reliability of creativity measures

The hypothesis stated that each creativity measure would demonstrate an acceptable level of internal reliability. The results indicated acceptance of Hypothesis 1 with some indication of lower internal consistency for specific domains on the CAL.

Table 20 provides an overview of some internal reliability coefficients from the research literature as compared with results of the present study.

Divergent Thinking (DT) Tests

The internal reliability of the Divergent Thinking (DT) Fluency and Unusual Responses tests appears to compare favorably with previous studies, considering the variability in population samples and the combination of DT tasks applied. Correlations obtained in this study within DT-FL and DT-UN as well as between the two tests also compared favorably with previous studies, as summarized in Table 21.

The procedures of the present study were similar to that of Milgram and Milgram (1976b). That is, the same four DT subtests were administered to the total sample in one session.

The samples were comparable in size (N=145 and N=157) and age level (high

Table 20

Comparative Internal Reliability Coefficients on Creativity Measures

Study	DT-FL	DT-UN	CAL-QT	TESC	PESC
Orieux (1988)	.86	.80	.70	.96	.86
Milgram & Milgram (1976b)	.93	.88	.23-.42*	-	-
Milgram, et al. (1978)	.75 -.83	.63	-	-	-
Milgram and Arad (1981)	.70 -.89	92	-	-	-
Runco (1984)	-	-	-	.96	-
Runco (1985/86b)	.88	-	-	-	-
Runco (1987)	-	-	.69-.85	-	-
Runco (1984)	.64	.59	-		
Runco (1986e)	.39-.74	.47-.79	.35 -.94		
Runco & Albert (1985)	-	-	.51		
Wallach & Wing (1969)	.59-.79	.37-.79	-		
Runco (1988, in press)	-	-	.63 -.78	.88 -.94	-
Runco & Albert (1985)	.64-.89	.81-.86	.94	.96	-

Note: Results reported as "coefficient alphas".
*Instrument used was similar to CAL.

Table 21

Comparative Correlations Within and Between DT-FL and DT-UN

Study	DT-FL	DT-UN	DT-FL/DT-UN
Orieux (1988)	.53-.82	.40-.76	.39-.94
Milgram & Milgram (1976b)	-	-	.78 -.81
Milgram, et al (1978)	-	-	.74 - .80
Milgram & Arad (1981)	-	-	.68
Runco (1984)	.64	.59	-
Runco (1986e)	.39 -.74	.47-.79	.35-.94
Runco & Albert (1985)	-	-	.51
Wallach & Wing (1969)	.59-.79	.37-.79	-

school seniors and grade 11 students) for Milgram and Orieux respectively. However, there were differences worth noting. Milgram's sample was comprised of Israeli students from a school with high academic standards; Orieux's sample consisted of Canadian students enrolled in a wide range of programs - vocational/occupational to high academic.

In comparison to the Runco and Runco and Albert studies, the contrasts are mainly with age and variability of samples (grades 5 to 8 and grade 11 students) for Runco and Orieux respectively. In addition, the Runco and Runco and Albert studies administered the DT tests to smaller groups of students using non-test procedures adapted from Wallach and Kogan (1965) as opposed to the large-group administration procedure of the present study.

To summarize, the present study has added a dimension to the research, using the Wallach-Kogan DT tests with a sample of Canadian students representative of a general high school population as compared to a select group of students (eg. gifted/talented program or high academic school) and has further confirmed the Wallach-Kogan DT tests to be internally reliable for use with a wide range of subjects with respect to age, level of ability and administration procedures.

Creative Activities Checklist (CAL)

The CAL Quantity Scale would appear to be a moderately reliable measure. Comparative data from the literature are depicted in Table 20 indicating a relatively wide range of reliability coefficients.

A second test of internal reliability, based on intercorrelations of the seven domains within the Quantity Scale, resulted in correlations at low to moderate levels with 17 of 21 correlations, excluding the composite scores, being significant (p<.001). These results compare very favorably with results obtained by Milgram and Milgram (1976b) who reported modest correlations (all p<.05) between nine areas and a total adjusted item score (total minus the area) of .28 (writing) and .49 (social leadership) for men; and .26 (fine arts), .26 (writing), .29 (social leadership), and .25 (sports) for women. Runco (1987) reported correlations between domains ranging from .14 (music/public presentation) to .70 (crafts/art). Music and Science had noticeably weaker relationships within the Quantity Scale in this study.

Interrater correlations (.917, .878, and .870, all p<.001) on the CAL Quality Scale indicate a higher reliability. The percentage of items with perfect agreement between the two independent raters is low, at 42%. Interrater reliabilities have been estimated previously, using product- moment correlations (e.g. Runco, 1984 - with the TESC). Runco (1987) used interrater percentage of agreement and reported 77% agreement for a randomly selected one-third of the questionnaires (N=76). Perhaps the smaller sample of questionnaires rated in this case (N=30 or 20%) would account partly for the lower rate of agreement. The correlation of the CAL Quantity scores with the Quality scores provide a further measure of internal reliability. Results, presented in Chapter IV (pp. 81 & 82), indicate low to moderate correlations, all significant with 11 of 49 coefficients at p<.001, excluding the composite scores. The relationship among the seven domains appears stable and reliable. These results are somewhat higher than those obtained by Runco (1987). Runco's sample (N=228) was divided evenly at the median score into two DT groups. The comparisons depicted in Table 22, are based on the average correlations of the two groups on each activity which comprised the total sample for Runco's study and the average correlations of the total sample on each activity for the present study.

One difference between the two samples is grade level, that is, Grade 11 students (Orieux) and with Grades 5 - 8 students (Runco). However, the samples are comparable as follows (Runco's results in parentheses): composite means 2.0 (1.93), standard deviations .53 (.54). Based on the fact that in the present study the instrument was administered, without revision, to a grade 11 sample, it is likely that the elevation in quality scores reflects the possibility that the grade 11 students have had a longer period of time in which to develop their abilities in the activity areas investigated by the checklist and relatively more maturity in expressing themselves.

A further observation worth noting pertains to comparative scores on the Quantity and Quality Scales. Runco (1987) reported notable differences between reliability indicators of the quantity and quality scores, with quantity scores having the higher values. In Runco (1987), for example, median coefficients of .46 and .49 were obtained on the quantity scale for the low DT and high DT groups respectively, as compared to .16 and .20 respectively on the quality scale. In the present study, reporting for the total sample, median coefficients of .33 and .32 were obtained for the quantity scale and quality scale respectively. Although direct comparisons cannot be made due to the grouped sample in the Runco study, it is worth noting that the differences between quantity and quality scores were not as large in the present study, and that the quality scores were relativley higher.

In summary, from the comparative data presented above, it is evident that the quantity and quality of creative performance are significantly related, as measured by the CAL composite scores. The reliability of this relationship, however, varies in significance and strength between specific creative activities or domains. In the present study, the quality scores demonstrated slighly higher internal reliability than the quantity scores - a somewhat different result than previous studies cited.

Table 22

Comparison of Average Correlations of CAL-QT with CAL-QL Domain Scores

Study	Writ.	Mus	Craft	Art	Sci.	P. Art.	P.Perf.
Orieux (1988)							
N=157	.35	.30	.34	.30	.26	.35	.35
Runco (1987) N=228	.16	.21	.18	.20	.22	.21	.22

Parents' Evaluation of Students' Creativity (PESC)

The PESC, with a coefficient alpha of .861, appears to have a high level of internal consistency. The use of this instrument is unique in this study in that a rating scale developed for use with teachers, the Teachers' Evaluation of Students' Creativity (TESC) developed by Runco (1984), was used with parents without changing the content, merely adapting the instructions for administration. Runco's development of the TESC was aimed at providing another dimension of creativity assessment which would lend 'social validity' to other creativity measures such as DT tests. In the present study, it was felt that extending this notion to using the TESC with parents, would expand the idea of 'social validation' should the PESC correlate favorably with other measures of creativity. Additionally, in correlating the PESC with the TESC, an indication of convergent validity, which will be discussed later in this chapter, could be attained.

Teachers' Evaluation of Students' Creativity (TESC)

The internal consistency of the TESC, with an alpha coefficient of .956, compares favorably with previous studies (see Table 20). The coefficients reported by Runco (1988, in press) were computed from three teacher ratings for a small sample of adolescents (N=29).

In summary, the four creativity measures discussed above appear to have acceptable internal reliability for use in research with a student population. The reliability of the CAL tends to drop off when specific domains on both the Quantity and Quality scales are considered.

Intercorrelations among creativity measures

In considering the relationship between the four creativity measures with their respective 'subtests', we examine the convergent validity of the instruments which Hypothesis 2 addresses.

The importance of obtaining significant correlations among measures of creative thinking ability (DT tests) and creative performance (self-report, rating scales) relates to construct validity and more specifically, establishing whether the four different measures of creativity demonstrate convergent validity. The results, reported in Chapter IV (p. 84), based on the total test scores, indicate the relationship between these measures is highly significant; that is, not occurring by chance. At the same time the relative strength of the coefficients indicates a moderate degree of shared variance among the measures, presumably a common construct of creativity, but with differences remaining among the measures as well.

DT and CAL

The literature reviewed has pointed out the issues faced in the development of divergent thinking tests with respect to using tasks which intercorrelated versus tasks which factored out on differing aspects of creative thinking (eg. Torrance, 1962; Wallach and Kogan, 1965). Although the initial goal of most research was to determine the separability of divergent thinking tasks from tasks of intellectual ability, there was also the issue of relating creative thinking ability to creative performance: could DT tests predict creative performance as expressed in real-life activities? Runco (1986a) has pointed out that divergent thinking ability is not equivalent to creative ability but it is indicative of the potential for creative performance. Barron and Harrington (1981) reported several studies in which statistically significant relationships have been observed between various DT test scores and reasonably acceptable non-test indices of creative behavior or achievement. However, they have cautioned that DT tests can often fail to correlate with plausible indicators of creative behavior and achievement mainly due to the field-specific relevancy and variability of some DT abilities and more so of indices of creative achievement and behavior used as criterion variables (eg. Milgram and Milgram, 1976b; Rotter, Langland, and Berger, 1971; Wallach and Wing, 1969). In other words, the DT abilities presumably underlying creative achievement probably vary according to the field of interest of the individual (eg. architect, musician).

The field-specific aspects of the measures of creative performance (eg. CAL, PESC, and TESC) in the present study become evident as we consider, as an example, the intercorrelation of the DT tasks with the CAL domains. The convergent validity observed among the total test scores does not hold in the intercorrelations of the 'subtests' of the

DT and CAL measures. This is evidenced by a wider range in both the level and significance of correlation coefficients, and some identifiable field-specific areas; for example, Art and Science having relatively low and nonsignificant relationships to the DT tasks. On the other hand, noticeably less variability is evident among the DT tasks.

If the DT tests are considered as measuring creative thinking ability, sometimes defined as a specific cognitive ability or potential, and the CAL scales considered as measuring creative performance (behavior or achievement), certain inferences, as brought out in the research literature, can be drawn. DT tests, developed to measure certain aspects of creative ability, which presumably differ from traditional intelligence tests, have psychometric properties designed to assess thinking through the generation of ideas and making associations. Fluency can be scored objectively and provides a reliable indicator of one aspect of creative thinking. Measures of creative performance, behavior and achievement, on the the other hand, involve self-report and ratings by others. In the case of the CAL, the reporting of preferred activities generates field-specific data which will result in the variability evidenced in the results of this study.

The literature cited has given support for the continued use of self-report measures (Runco, 1986c; Milgram, 1983; Wallach, 1985). Hence, with respect to the DT tasks intercorrelating with the CAL domains, we have examined certain patterns specific to the activity (eg. Writing, Art, Science) but should not draw conclusions as to whether certain DT tests are good or better predictors of specific activities.

PESC and TESC

The highly significant correlation of the PESC with the TESC (r.387, p<.001) indicates the convergent validity of these two rating scales. As previously explained in Chapter III, the Parents' Evaluation of Creativity (PESC) was introduced as an instrument unique to this study.

To review briefly, Runco (1984) developed the TESC as a method of obtaining data from teachers about their notion of creative behavior in their students. A second, but perhaps more important purpose, was to establish the TESC as a scale of social validation of other creativity measures, e.g. DT tests. That is, should significant correlations between the TESC and DT tests be obtained, it would demonstrate that DT tests, in addition to construct validity, would also possess social validity, assuming of course that the TESC demonstrated internal consistency and convergent validity with other creativity measures. Social validation is defined as the extent to which a traditional psychometric evaluation agrees with or predicts the subjective judgement of "significant others" (Kazdin, 1977; Wolf, 1978).

Rather than develop a scale for parents, the researcher found the prospect of using the same rating scale with both teachers and parents as attractive. First, if the scale withstood statistical tests of reliability, it could prove useful as a relatively easy instrument to administer to parents. Secondly, the general idea of parents and teachers having different perceptions of the student, often in opposition, might be clarified through the use of a common rating scale. Finally, if the PESC correlated favorably with the DT tests and the CAL, this would further expand the 'social validation' of these creativity instruments as proposed by Runco (1984).

Results, as reported in Chapter IV (Table 5, p. 83), indicate that the PESC has highly significant correlations with all creativity measures ($r=.325$ - $.387$, $p<.001$) and, on the basis of this study, has potential as a valid rating scale with parents and in contributing to the social validity of DT tests and self-report instruments such as the CAL. Results from the TESC, used with this sample of high school students, were also highly significant ($p<.001$), with somewhat lower coefficients on the CAL scales ($r=.257$ and $.313$, $p<.001$).

A brief look at the TESC is also warranted here. The fact that, in the present study, students were rated on the TESC by 32 different teachers in 9 different subject areas rather than by two or three teachers in one subject area makes the results obtained, both for internal consistency and convergent valdity, somewhat startling. It would appear that the TESC might be reliable for use with older students and with a variety of raters in conjunction with other measures of creative ability and performance.

Relationship between intelligence and achievement

The hypothesis addressed the convergent validity of the measures of intellectual ability and academic achievement. In the literature reviewed, with respect to creativity in relation to intellectual ability and academic achievement, results have generally reflected a strong correlation between IQ scores and achievement measures, but neither of these have usually correlated highly with measures of creativity (e.g. Getzels and Jackson, 1962; Wallach and Kogan, 1965; Wallach and Wing, 1969). Additionally, the validation of group-administered tests of intelligence with achievement batteries is a well-established practice; for example, the Test of Cognitive Skills with the Canadian Achievement Test (McGraw-Hill), the Canadiana Cognitive Abilities Test with the Canadian Test of Basic Skills (Nelson), and the Otis-Lennon School Ability Test with the Metropolitan Achievement Test (1978). Generally, high correlations are reported between these intelligence and achievement batteries.

Results reported in Chapter IV indicate highly significant correlations between the O-LSAT and the five measures of achievement ($r=.419$ - $.675$, $p<.001$), which confirms convergent validity. It should be noted, as well, that the correlations between the achievement measures were as high or higher than their respective correlations with the O-LSAT.

One concern regarding the assessment of achievement in the present study was the absence of current standardized test results on school records and time limitations with respect to administering an achievement battery as part of the study. This left the prospect of relying on teacher-assigned marks as the criterion of academic achievement. To balance achievement results, the Grade 9 Provincial Achievement Test (PAT) was selected as a satisfactory standardized instrument available for the majority of students (150 out of 157). As indicated above, this test correlated significanfly with the O-LSAT as well as the teacher-assigned marks (S.S.10, GPA), establishing convergent validity among the achievement measures as well as with the measure of intellectual ability.

Relationship between creativity and intelligence or achievement

The literature reviewed has borne out a moderate to low relationship between creativity and intelligence. For example, Getzels and Jackson obtained correlations from .12 to .39 between divergent thinking measures and IQ measures. A comparison between the Torrance tests (TTCT) and scores on a variety of group and individual intelligence tests typically fell between .15 and .40 (Wallach, 1970; Yamamoto, 1966). Similar results are reported for creativity measures correlated with achievement tests. For example, McKinney and Forman (1977) found an average correlation of .15 between the Wallach-Kogan DT tests and composite scores on three subtetss of the Iowa Test of Basic Skills. The results of the present study support the findings of the previously cited research with correlations ranging from .104 to .434 between creativity and intellectual ability and correlations ranging from .106 to .573 between creativity and achievement.

The purpose of many investigators has been to determine the discriminant validity of creativity measures in comparison to intelligence and achievement measures. Wallach and Kogan (1965) and Wallach and Wing (1969) have thoroughly discussed the importance of creativity measures having discriminant validity. That is, such measures should demonstrate that they are discriminating between cognitive abilities, as measured by IQ and achievement tests, and creative abilities or characteristics that they are purported to measure even though they will usually share some common variance of general intelligence. The results of the present study indicate that the creativity measures have moderate discriminant validity with respect to their relationship with the measures of intellectual ability and academic achievement, with the exception of the CAL Quantity Scale. However, the non-significant results raise the probability that these correlations occurred by chance. With respect to the two relatively higher correlations between the TESC and two achievement measures (S.S.10 and GPA), the common element would appear to be that all three measures involve teacher judgement.

Threshold Theory: Creativity and Intelligence

The hypothesis stated support of the "threshold theory"; that is, although correlations between intellectual ability and creativity measures may be significant in the overall sample, correlations with creativity measures will be lower and non-significant for students in a "high ability" group (with DIQ's of 125+).

Results, reported in Chapter IV (Table 9, p. 90) indicated a sharp contrast between the total sample coefficients and the coefficients of the four groups based on DIQ scores. There was one significant correlation with the TESC in the "high ability" group (.370, $p<.05$). All other coefficients were low negative, low positive and non-significant. The hypothesis was rejected on the basis that the correlation procedure did not discriminate between the four groups, namely, an expected stronger relationship between IQ and creativity in all but the top group.

In examining the total sample scores, it is evident that there is a significant correlation between the measure of intellectual ability and the measures of creativity with two exceptions (PESC = .133 and CAL-QT=.104, $p>.05$). The procedure of forming four groups according to DIQ level resulted in a small number of subjects in each group which has had the effect of lowering the coefficients; in other words, the effect of the limited variability of the correlations. The formation of two or three groups would have possibly resulted in higher and a better distribution of coefficients. However, the necessity to identify students with DIQ's above 120 or 125, with respect to testing the threshold effect would have been compromised.

Previous investigations of the threshold theory have produced conflicting results: in support of the creativity-intelligence distinction (eg. Milgram, 1983; Milgram and Milgram, 1976a & b; Milgram, et al, 1977, 1978), and contrary to the theory (e.g Kogan and Pankove, 1974; Runco and Pezdek, 1984; Runco and Albert, 1986). These inconclusive results can be attributed partly to the variety of instruments used to measure IQ and creativity, and the varied samples selected for study, for example, restricted gifted samples and samples with a wide range in age of subjects.

A recent study by Runco and Albert (1986) correlated IQ and DT scores within four IQ groups to test the threshold effect, using the Wallach-Kogan DT tests as a measure of creative ability. The only significant coefficients were those between IQ and verbal fluency (.25, $p<.05$) and verbal flexibility (.27, $p<.05$) in the IQ 131 - 145 group. All other coefficients were nonsignificant with average coefficients for IQ groups as follows: IQ 98 - 120 (.02); IQ 121-130 (.12); IQ 131-145 (.15); and IQ 146-165 (-.12). The following results from the present study are presented even though the four IQ groups do not correspond with Runco and Albert's study. There were no significant correlations for the DT tests. The average coefficients for DIQ groups were as follows: DIQ 77 - 99 (.30); DIQ 100 - 112 (.08); DIQ 113 - 124 (.03); and DIQ 125 - 150 (.33). For both studies, correlations between IQ and DT were generally non-significant at a low level, and results did not discriminate between the top IQ group and the remaining three groups.

In summary, in this particular investigation support of the threshold effect was at best inconclusive and hence, insufficient to support the threshold theory.

Threshold Theory: Creativity and Achievement

The hypothesis under discussion extended the threshold theory of the creativity-intelligence distinction to the relationship between creativity and achievement. Briefly stated, if the correlation between intellectual ability and academic achievement is significant, usually at moderate to high levels, it follows that the correlation between achievement and creativity should be comparatively low and non-significant for students within the higher ability levels (eg. DIQ=125+).

As indicated in Chapter IV (pp. 89-93), results did not support the threshold theory and were generaly inconclusive with respect to specific trends among the four DIQ groups. Runco and Albert (1986) correlated DT Fluency, Originality and Flexibility scores with California Achievement Test (CAT) composite scores within four IQ groups. The stronger and most highly significant correlations were obtained in the top IQ group (146 - 165) for all six creativity measures, refuting the threshold theory. According to Runco and Albert, it would appear that academic achievement and IQ relate to creativity in significantly different ways.

In the present study, there was an overall increase in the correlations, both in terms of strength and level of significance, between creativity and achievement for the four DIQ groups as compared to the strength and significnace of the correlations between creativity and intellectual ability. Perhaps this reflects the different relationship of academic achievement and intellectual ability to creativity alluded to by Runco and Albert. An important contrast worth noting is that, for the total sample on each measure, correlation coefficients increased in terms of strength and significance as compared to the correlations of the individual groups. As noted previously, the formation of four groups results in smaller sample sizes, thereby creating an overall lowering of the coefficients.

In summary, the examination of the relationship of creativity and achievement within DIQ groups was similar to the creativity - DIQ comparison in that there was limited discrimination between DIQ groups and that the threshold hypothesis was not upheld. In addition, there was a similar contrast of stable, highly significant total sample scores contrasted with generally lowered and non-significant coefficients for all four DIQ groups.

Gender differences in intelligence and achievement

The hypothesis stated that there would be no significant difference between males and females on measures of intellectual ability and academic achievement.

Results of a one-way MANOVA indicated an overall gender effect (F(6,139)=2.29, p<.05). Upon examination of the univariate analyses, two significant gender differences were found for PATOT (F=6.40, p<.02) and for PAMC (F=5.10, p<.03) in favor of females on both measures. The fact that the PAMC contributes 50% of the weight to the PATOT score would indicate an effect of overlapping scores; that is, looking at one source rather than two regarding this significant difference in means between males and females. There was no corresponding significant contrast on the measure of intellectual ability or on the remaining achievement measures. However, it is notable that females obtained the higher mean scores on all measures. The literature reviewed, with respect to gender comparisons on measures of intelligence and achievement within the context of creative ability, has not revealed conclusive results in favor of males or females with respect to either intelligence or achievement. For the sample under study, however, there would appear to be a trend in favor of females.

In summary, the hypothesis was accepted with one difference in achievement remaining inconclusive.

Gender differences in creativity

The hypothesis stated that there would be no significant differences between the mean scores on measures of creativity for males and females.

An examination of the differences between males and females on the creativity measures indicated that females generally performed significantly better than males on measures of creative thinking ability (DT tests) and creative performance (CAL). Previous research reports mixed results on gender effects. For example, Milgram, Milgram, et al (1975) found gender differences (favoring females) on ideational fluency for a subsample of grade 12 girls. Runco and Albert (1986) found no gender effect on DT scores for a sample of students in grades 5 to 8. Milgram and Milgram (1976b) in a study with high school seniors on creative thinking and creative performance, found that females surpassed males on the number of different areas of creative activity in which they participated, did not differ significantly on the quantity of activities within each area, and were more involved in the performing arts as compared to males who showed a preference for science. In addition, females obtained higher scores than males on creative thinking (DT) and earned higher grades in school, but did not differ in intelligence.

As reported earlier in the results, for both the DT-FL and DT-UN, females obtained higher mean scores on all tests with significant differences from males on both composite scores and specific tasks. On the CAL, females again consistently obtained higher mean scores on all tests with the exception of Science, where boys scored higher on both the quantity and quality scales. However, the differences in means were not significant. Females differed significantly from males in specific performance areas: quantity of creative activities in writing, crafts, and the performing arts; and quality of creative activities in writing, crafts, arts, performing arts, and public presentation.

This consistently superior performance on the creativity measures by females in the sample under study might be attributed, in part, to higher intellectual ability in this particular female sample. However, the difference in means for ability between males and females was not significant (F=2.46, p>.10). As well, correlations between IQ and the creativity measures were typically low and non-significant. A second possibility would be a higher level of academic achievement in the female sample. This is partly confirmed in the significantly higher mean scores obtained by females on the Provincial Achievement Test total score (F=6.40, p<.02)and on the multiple choice subtest (F=5.10, p<.03), which represent Grade 9 Language Arts achievement critieria. However, there were no significant differences between the two groups on teacher assigned marks (Social Studies 10 (F=.05, p>.80)and GPA (F=1.77, p>.10)). A third possibility, taking creative writing as a point of discussion, is that higher ability in divergent thinking, and more specifically, ideational fluency, will enhance creative writing performance. Females were clearly better than males in terms of both quantity and quality of creative writing as reported on the CAL. In addition, females were significantly above males on four of eight DT tasks as well as on both total or composite scores for fluency and unusual responses. The correlations of the DT-FL total score with CAL-QT Writing (r=.367, p<.001) and CAL-QL Writing (r=.226, p<.01) indicate somewhat low but highly significant relationships.

In summary, the investigation of gender differences on measures of creative ability and performance revealed a consistently superior performance by females which cannot be conclusively explained. There is one possible implication which links the higher performance in both achievement and creativity by females, namely a facility with written expression. This special facility would enhance performance in divergent thinking tasks and in expression on instruments such as the Creative Activities Checklist; or perhaps the converse is true, that high divergent thinking ability, which usually requires above average intellectual ability, enhances creative writing talent and verbal expression.

Comparison of High Creatives and Low Creatives

The hypothesis stated there would be observable differences between selected High Creative and Low Creative groups for each creativity measure with respect to average intellectual ability and academic achievement scores. As described in Chapter IV, the top 15 and bottom 15 students based on rank ordered scores, were selected for each creativity measure and designated as High Creative and Low Creative groups. Results of the comparison of the High and Low Creative groups on each creativity measure in terms of average ability and achievement have provided some interesting comparisions and contrasts. The results will be first discussed in terms of each creativity measure followed by some overall summative observations and conclusions.

PESC and TESC

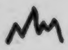
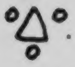
A brief description of these two instruments at this time should help in placing this discussion in context. Both rating scales have the same content; that is, 25 items, of which four are stated negatively and used as a response validity control but not included in the scoring. Hence, 21 items consisting of single words of phrases are rated on a 7 point Likert-type scale (see copy of instrument in Appendix B). Parents were asked to rate their son/daughter without discussing it with them. One or both parents could complete the scale. Teachers rated as few as two students or a maximum of twelve students. There was no interpretation of the terms given to the parents or teachers. They were asked to respond from their understanding of the terms and their knowledge of the student.

Results, depicted in Chapter IV have provided the raw data for the comparisons. It appears from the comparative ratings between teachers and parents on this creativity scale, that teachers tended to recognize intellectual ability and academic achievement more noticeably than parents, judging from the wider spread between High and Low Creative groups. This result is not surprising considering the context in which a teacher would be rating the student as compared to the parent. However, teacher and parent ratings corresponded to the same achievement measures. For example, students rated by both parent and teacher as highly creative were also highest in the PAWR test and similarly, students rated as least creative by both, were lowest in S.S. 10.

In terms of agreement in ratings, for students rated most highly creative, parents and teacher identified 3 out of 15 (20%) of the same students as compared to 4 out of 15 (26.6%) of the students rated as low creative. Generally, the two instruments, the PESC and TESC, appear to be internally reliable and potentially useful in being used together along with other criteria.

In summary, from the view of both parents and teachers, students who exhibit creative characteristics such as "self-directed", "exploratory", "innovative" and "nonconforming", also appear to have high average or above average intellectual ability and academic achievement. Conversely, students not rated highly on these characteristics tend to have lower average ability and achievement levels.

DT Tests

To review briefly, students were directed to write down as many ideas as possible on four tasks of three items each, which asked such questions as: "How many uses can you think of for a 'shoe'?", or, "How many ways are a tractor and a train alike?". They were also prompted by figural tasks, lines, and patterns, and asked how many different meanings were conveyed to them by the drawings, e.g.  or . Students earned a total frequency score (Fluency) or a statistically infrequent score; that is, ideas given by 5% or less of the total sample (Unusual Responses).

Looking at the profiles in Chapter IV (Table 19, p. 109 and Figures 7.1 and 7.2, p. 113), we find that the divergent thinking measures (DT-FL and DT-UN) have the closest comparability. This is primarily an artifact of the DT-UN scores being a statistical subset of DT-FL totals. In fact, 13 out of 15 students (86.6%) were in the "high creative" group on both measures. Extending this downward to the top 30 students, 23 or 76.6% of the students were in the "high creative" group on both measures. This feature, in itself, is supportive of the theoretical position that high ideational output or fluency is a necessary precondition for the production of rare or unusual ideas (Guilford, 1957, 1967; Mednick,1962; Wallach and Kogan, 1965), remembering that the data presently under discussion are rank orders (ordinal data). An identical result was observed at the opposite end of the scale with 13 out of 15 (86.6%) students in the "low creative" group on both measures.

CAL

The CAL (see copy Appendix B) consisted of two parts. The first part was a rating by the student of the frequency (1- Never, 2- Once or Twice, 3- Three to Five , 4- Six or more) of certain creative activities in 7 domains (Writing, Music, Crafts, Art, Science, Performing Arts, and Public Presentation) that he/she has participated in over the past two years. A summation of these ratings formed a Quantity score (CAL-QT). Second, at the bottom of each section, the student was asked to describe one or two of his/her best activities and elaborate on how they were used or when they received recognition. These were rated on a 10 point scale (see Appendix B) by the researcher and produced a Quality score. Hence, student self-report contributed to both scores, even though rater judgement was involved in determining the Quality score (CAL-QL) only.

The two scales of the Creative Activties Checklist (CAL-QT and CAL-QL) present some notable contrasts. Looking at IQ in terms of comparative levels and range, the CAL-QT scores reflect the lower-middle ability group with negligible difference between the High and Low groups whereas the CAL-QL scores discriminate between the High and Low ability students. The same pattern follows with achievement scores.

There is a similarity in the number of identical students found in the High and Low groups of both scales. There were 6 out of 15 (40%) in the High group of each scale as compared to 3 out of 15 (20%) in the Low group of each scale.

A final comparison refers to the relationship beween quantity and quality of creative performance, as measured by the CAL. It appears that for this sample, the theory of fluency as a precondition of unusual or rare ideas does not extend to quantity of creative activities as a precondition of quality of creative activities. This relationship was investigated by Milgram and Milgram (1976b). They found that, in a sample of 145 high school seniors, students who reported a large number of creative activities across many areas also reported high quality, unusual activities in some areas (p. 255). In the present study, the CAL Quality Scale results are not contingent on the Quantity Scale results and have demonstrated a relatively stronger relationship with the other measures used in the study.

In summary, an overall comparison of High Creatives and Low Creatives on the six creativity measures reveals that four of the measures (TESC, DT-FL, DT-UN and CAL-QL) are comparatively consistent in the identification of these students in terms of ability and achievement levels. The remaining two measures (PESC and CAL-QT) do not appear to discriminate between High and Low Creatives to the same extent. The distinction between the quantity and quality of creative performance, as expressed above, is somewhat novel in that several studies have shown a quantity rating of creative performance as having stronger psychometric properties than a quality rating. Before drawing conclusions, it would be necessary to examine more closely, the reliability and validity of each scale with a particular sample of students. For example, in the present study, the CAL was not adapted for high school students.

Profiles of Most and Least Creative Students

The Most and Least Creative students, as profiled, demonstrate several contrasts. First, with respect to intellectual ability, the Most Creatives fall within a narrow range (13 IQ points) of the Superior intelligence classification; the Least Creatives span a wider range (29 IQ points) from the Low to High Average intelligence classification. Second, choice of school program is correspondingly different: Most Creatives selecting the university entrance program and Least Creatives selecting a general diploma route. Third, career choices reflect the latter program choices; that is, Most Creatives express a preference for a professional career, whereas Least Creatives express a preference for careers or occupations in the trades, clerical/business world, and service work such as policemen and firemen.

A fourth contrast is observed with respect to interests and extra-curricular activities. Most Creatives report a wider range of such activities than Least Creatives with some connection between their school elective courses (eg. school band, performing arts) and out of school pursuits. The interests and activities of the Most Creatives reflect involvement and some degree of leadership. Least Creatives are less expressive in listing leisure-time activities with sports, listening to music and being with friends bieng typical of the activities they listed.

A final contrast, by no means least in importance, is the description of creative activities submitted on the Creative Activities Checklist (CAL). Most Creatives are definitely more expressive in reporting such activities: 17 activities listed by the four Most Creatives as compared with 5 activities listed by two of the Least Creatives. Activities listed by Most Creatives, once again span a wide variety of accomplishments, reflecting talent areas such as music, drama, art, creative writing, and involvement in organizations. Least Creatives, being less expressive, have emphasized making things, which also reflect artistic talent and writing.

In summary, the two groups of students selected for descriptive profiles on the basis of their "creativity" scores were markedly contrasted in terms of both intellectual ability and academic achievement. In terms of the creativity measures, the divergent thinking (DT) test scores, both fluency and unusual responses, were remarkably different for the two groups as were the CAL-Quality scores. One of the pervading factors would appear to be the ability and, perhaps, motivation for self-expression, in this case, in written form. The Most Creatives, who were also the higher ability students, had the facility to share about themselves in terms of accomplishments and future plans. Their divergent thinking expression, from a brief review of the responses, was varied, often humorous and went beyond the factual or expected solutions of responses. On the Creative Activities Checklist, some of the Least Creatives expressed the fact that they never did too many things which would gain public recognition, even at school.

This comparison does not reveal whether a student with high ability and achievement results but not with concomitantly high scores on the creativity measures used in this study, would project a profile similar to the Most Creative students in the profile.

Conclusions

In drawing conclusions from the results discussed in this study, it would be useful to return to the purpose of the study and review the objectives in order to determine to what extent they have been addressed.

To review briefly, the primary purpose was to investigate correlates of creative ability and performance in a high school student population. In a post-facto design approach, correlations were examined and relationships between several characteristics of the students were analyzed.

The first objective addressed the viability of using a multi-dimensional approach in assessing creativity within a school setting. The literature reviewed raised the issue of creativity being difficult to define and therefore, to assess. Research on the distinction between intelligence and creativity has brought forth the importance of going beyond the IQ score or a single test of divergent thinking in the assessment of creativity. The importance of considering creative performance in addition to creative ability in assessment procedures has also been raised in the literature.

In the present study, it was found that the use of four creativity measures to assess a relatively large group of high school students, and to obtain reliable results, was viable. The most significant results obtained, pertaining to this objective, were: (1) the favorable internal reliabiltiy of the four measures, and (2) the convergent validity of the four measures, taking into account the limited time available and the large-group setting used for testing. In addition, one instrument (PESC) was used in research for the first time.

The second objective addressed whether students rated as high creative would also be students with high intellectual ability and academic achievement levels, and whether males and females would differ notably on measures of creativity, intellectual ability and achievement.

Central to the above objective was the research literature on the threshold theory as it pertains to the relationship of creativity and intelligence. The theory implies that creativity and intelligence are significantly correlated up to higher levels of IQ (eg. 120+) at which point the relationship between these two constructs diminishes; that is, creativity and intelligence appear to be independent of one another. The literature reports contradictory and inconclusive results regarding the threshold hypothesis. In addition, research on gender differences pertaining to intelligence, achievement and creativity was reviewed. There are no conclusive results indicating the superiority of one gender over the other with respect to these areas. Two significant findings were obtained in the present study pertaining to this second objective: (1) Results of an analysis of the relationship between the measures of creative ability/performance and academic achievement for subjects grouped according to IQ, were not supportive of the threshold theory, and (2) data on intellectual ability, academic achievement, and the creativity measures were analyzed to determine gender differences. Results revealed significant differences in favor of females on two achievement measures and on four of six creativity measures. In fact, females had higher mean scores on all measures with the exception of two subtests on one creativity measure. It was interesting to note from the profiles on the six creativity measures that there were 62 females and 28 males in the High Creative groups compared with 22 females and 68 males in the Low Creative groups.

A third objective was to examine the characteristics of subjects designated as high and low creative and to develop descriptive profiles on selected students for each group. The research literature on the assessment of creative performance has raised the importance of using self-report data on creative activities and products, as well as ratings by signficiant others. Research pertaining to creativity in adolescents has examined the personal-social characteristics of adolescents and, most important, the link between hobbies, interests and extra-curricular activities with future "real-world" creative pursuits.

The top and bottom 10% of students, selected from rank-ordered data on six creativity measures, were designated as High and Low Creatives for the purpose of drawing comparisons. Subsequently, two smaller samples, four Most Creatives and four Least Creatives were selected for more specific profile analysis. The most significant findings pertaining to the third objective were: (1) Most Creatives scored within the superior range of intellectual ability and at a high average level of academic achievement whereas Least Creatives scored within the average range of intellectual ability and at an average range of academic achievement. This finding, with respect to the Most Creatives, also refutes the threshold theory, and (2) profile comparisons of Most and Least Creatives reflected school programs and interests commensurate with level of intellectual ability and achievement. A key distinction between Most and Least Creatives was the ability of the Most Creatives for better self-expression with respect to interests, activities, and future goals.

Implications of the Study

From the conclusions discussed above, which presented the major findings, there are certain implications regarding the future use of creativity assessment instruments and the relative value of the information obtained from the students, teachers, and parents.

First, this study has demonstrated that it is possible to obtain reliable data from a large sample of high school students using several assessment devices, within a relatively short period of time. This has an important implication for the further use of divergent thinking tests, which are often administered to smaller groups in a non-testlike setting and allowing more time.

Second, the introduction of the parent rating scale (PESC) in conjunction with the teacher rating scale (TESC) has shown both scales to be reliable and significantly related. These instruments have potential for further use in obtaining paretn/teacher validation of student characteristics. The information obtained from these two sources reflected the subtleties of rating students from two frames of reference: school and home. In addition, on the TESC, it was surprising to obtain a significant level of reliability when the rating of students was so widely distributed among several teachers and subject areas.

Third, the use of student self-report would appear to be a valuable source of information for educators in obtaining a more complete picture of a student's interests and abilities beyond academic abilities, in order to enhance a student's learning experiences and to encourage talent development.

Fourth, there are implications that creative ability and performance, as operationalized in this study, are contingent on at least a high average level of intellectual ability and that fluency of expression is a key characteristic.

Limitations of the Study

The study conducted was limited by certain factors which, had they been foreseen and controlled, might have improved certain aspects of the research. In addition, other aspects of the study proved to be impractical.

First, the fact that the sample of students was selected on a "volunteer" basis, that is, based on parent consent, meant that approximately 53 percent of the sample population was not represented in the study. Hence, a generalization of the results to the entire Grade 11 population of the school cannot be made. A randomly-selected sample would have likely been more representative. Nevertheless, the sample analyzed in the study comprised students from a wide range of intellectual ability, academic achievement and creativity.

Second, the time alloted by the school to obtain the data from students and teachers was limited. With additional time for assessment, it would have been desirable to administer a standardized achievement test and/or an expanded interest inventory. However, one of the realities of conducting research in a high school is that students are on a semesterized program. Hence, instructional time is at a premium. In addition, because students have individual schedules it was relativley difficult to arrange for testing times.

Third, the divergent thinking (DT) tests, even though proven as a stable and reliable instrument under the administration procedure used, are incredibly time consuming to score, especially for a large sample (N=157). In order for several individuals to score smaller numbers, there is a requiremnt of being totally conversant with the scoring criteria and classification of responses in order to obtain valid results.

Fourth, for the teacher rating scale (TESC), a larger sample of students rated by two teachers in the same subject area would provide a more valid interrater reliability result. This does demand a significant amount of teacher time.

Fifth, it would have been valuable to add one more dimenision to the rating of students, namely peer ratings. At a high school age, a student's peers are important to them and likely have valuable insights to offer. To have a student report on himself and be rated by parents, teachers, and peers would provide a more complete profile on that student's characteristics. From the standpoint of logistics (time and scheduling) it was difficult to visualize how appropriate peeers could be selected and what type of instrument to use.

Finally, it would have been valuable to have conducted interviews with the four Most Creative and four Least Creative students, in order to obtain more "in depth" information on their impressions of school experiences and personal interests.

Suggestions for Further Research

This study set some preliminary parameters with respect to the investigation of creative ability and performance in a high school setting, which should encourage further investigation through either an extension or refinement of the present research.

First, further use of the Wallach-Kogan DT tests with high school students is recommended, providing the administration and scoring is shared by sufficient persons to reduce the workload. The administration of the DT to an entire group in one sitting is manageable and has the advantage of reducing the possible violation of reliability which might occur of the test were administered to several smaller groups at different times; that is, students are not able to communicate the content of the test to subsequent test takers.

Second, a revised version of the Creative Activities Checklist (CAL), better adapted to high school students would be valuable. The present instrument was developed for use primarily with students in grades 5 to 8. Some of the activities suggested may have been somewhat immature for older students. As pointed out in the literature, Runco developed the present instrument by adapting similar checklists developed by Hocevar, Milgram, and Wallach and Wing. Milgram and Runco may well be in the process of further developing such a checklist for older adolescents.

Third, the development of a peer rating scale, possibly using the same format as the TESC and PESC, used in this study, would provide an additional dimension to self-report and ratings by others. In addition, it would extend the breadth of the social validation of creativity instruments, as presented by Runco.

Finally, a follow-up of the students from the present study, who were identified as High Creatives, in terms of their career pursuits and talent development is recommended. This follow-up could provide a valuable source of ecological validity to the process of creativity assessment and the notions raised in the literature pertaining to the predictive power of adolescents' extra-curricular and out-of-school activities in determining real-world creative accomplishments, as compared to school marks and academic standing.

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Appendix A

PHONE 963 2231

YOUR FILE ________
OUR FILE ________

COUNTY OF PARKLAND NO. 31
OFFICE OF THE SUPERINTENDENT OF SCHOOLS

STONY PLAIN, ALBERTA
T0E 2G0

1987 05 27

Mr. J. A. Orieux
Director of Student Services
County of Parkland No. 31
Stony Plain, Alberta
T0E 2G0

RE: Research project on Correlates of Creative Ability and Performance in High School Students

I have reviewed your proposal and hereby grant permission for you to proceed with the research in Spruce Grove Composite High School, subject to the following:

1. The research must first be approved by the Ethics Committee of the Department of Educational Psychology.
2. The students identified for the study must be willing participants and if necessary, parent/guardian consent should be obtained.

I hope your project is successful and you reach your academic goal.

Yours truly,

M. W. Tkachuk

M. W. Tkachuk
Superintendent of Schools

MWT/sln

RECEIVED
MAY 28 1987
Ans'd..................

September 21, 1987

Dear

Mr. Jim Orieux has been granted permission by Mr. Marv Tkachuk, Superintendent of Schools, and Mr. Ron Anton, Principal, to conduct a research project at Spruce Grove Composite High School this Fall as part of his doctoral studies in Educational Psychology at the University of Alberta.

In this study, we are investigating certain abilities and performance among high school students which may not always be reflected in school achievement or by a student's measured potential. These abilities are sometimes identified as talents or thought to be indicative of creative thinking potential. They are often strongly related to or evident in extra-curricular activities and out-of-school interests and achievements. In identifying such abilities and, in some cases, actual performance, it is our hope that such information, combined with information on school achievement, will further improve the school's challenge to meet the needs of students, some with very exceptional abilities. On a more personal basis, it is felt that students participating in the project will benefit in relating their interests and present activities to career choices and "real-life" goals.

All students in Grade 11 will be given the opportunity to participate in this study. They will be involved in the following tasks:

1. a group-administered test of general ability
2. a measure of creative thinking
3. a checklist of activities reflecting talent or creative performance
4. an inventory of interests, achievements, out-of-school activities -- e.g. employment, etc.

It is anticipated that the maximum time to complete the above tasks will not exceed the equivalent of two instructional blocks (a total of 160 minutes). This will be carried out during October, 1987.

One very important condition of research using persons as subjects, is that confidentiality be ensured. This is a requirement of the University of Alberta and the County of Parkland. Accordingly, all information will be handled by the researcher and one research assistant, Mrs. Anne Shillington, who will be authorized to act in this capacity. The researcher, Mr. Jim Orieux, is an employee of the County of Parkland, serving as Director of Student Services and, hence, has been closely involved in dealing with confidential information on students over the past ten years. All data will be presented anonymously, based on sample groups in the study. Should individual cases be discussed to emphasize a particular example, a fictitious name will be used.

We value the inclusion of your son or daughter in the study and would appreciate your participation in the following ways:

1. **We will require your consent to have your son or daughter participate in the study. This can be done by signing the "consent form" at the bottom of page 2.**

2. **We request that you complete the attached "rating scale" on your son or daughter.**

2...

Teachers will also be completing a "rating scale" on students participating in the project.

Please return both the signed consent and the completed rating scale in the enclosed self-addressed envelope, which also contains prepaid postage, no later than September 30, 1987.

It should be noted that all costs for this research project are the responsibility of the researcher and not the County of Parland.

Thank you for considering this request and we are looking forward to working with your son or daughter and with you as parents. We will be happy to share results of the project on request. If you have any questions regarding the project or in filling out the rating scale, please direct them to:

Jim Orieux - 963-2615 (home) 963-2231, Ext. 376 (office)

Sincerely,

J.A. Orieux, M.Ed.
Doctoral Candidate
Researcher

C.R. Yewchuk, Ph.D.
Professor of Educational Psychology
Thesis Supervisor

(Please tear off here and return bottom portion)

CONSENT FORM

I hereby give my consent to have my son/daughter ______________________ participate in the above-described research project at Spruce Grove Composite High School.

______________________ Parent/Guardian's Signature

______________________ Date

Box 597
Stony Plain, Alberta
T0E 2C0
November 4, 1987

Dear

RE: RESEARCH PROJECT AT SPRUCE GROVE COMPOSITE HIGH SCHOOL

On Friday, October 23, 1987, students completed the tasks for the research project during Blocks 1 and 4. The sessions went extremely well with approximately 150 students participating. You had submitted your completed "rating scale" and signed consent to have your son/daughter participate in the project. Unfortunately, ______________ was absent in Blocks 1 and 4 on that day.

It is my wish to make another opportunity available for the participation of those students who were absent. However, the school cannot afford additional instructional time to be used for this purpose. Therefore, I am prepared to hold a session on Saturday morning, November 14, between 9:00 a.m. and 12:00 noon, either at the school or at the County Services Building, Stony Plain. This extra session will be held providing there is a sufficient number of students interested. Please indicate your intention to have ________________ attend by contacting me at 963-2231 (Ext. 376) between 8:00 a.m. and 4:30 p.m., or at 963-2615 after 5:30 p.m. by Thursday, November 12.

Thank you for your consideration of this offer.

Sincerely,

JAOrieux

J.A. Orieux
Researcher

A SPECIAL OPPORTUNITY

WHO:	All Grade 11 Students.
WHAT:	Participation in a project that is investigating the unique abilities, talents and performance of high school students.
WHERE:	Spruce Grove Composite High School Cafeteria
WHEN:	Friday, **October 23, 1987** [Blocks 1 and 4]
WHY:	We need a **large** number of Grade 11 students to obtain results for a research study. The results wil be used in **Mr. Jim Orieux's** doctoral thesis at the University of Alberta, Department of Educational Psychology. Following the study, if you are interested, the results can be discussed with you to give you a better understanding of your abilities.
HOW:	Your parents will receive a consent form, letter of information, and a survey in the mail. If your parents consent, you will complete some surveys for us on **Friday, October 23.**
* * *	If you have any questions, **Mrs. Anne Shillington** , Project Research Assistant, will be in the **Conference Room, Friday, September 25,** from **11:30 a.m.** to **12: 25 p.m.** to answer your questions.

We look forward to working with you !!!

THANK YOU !!!

INFO-MEMO

TO: Teachers of Grade 11 Students
FROM: Jim Orieux
SUBJECT: Research Project on Student Creativity
DATE: September 21, 1987

I have been granted permission by Mr. Marv Tkachuk, Superintendent, and Mr. Ron Anton, Principal, to conduct a research project in your school as part of my doctoral studies in Educational Psychology at the University of Alberta. I will be assisted in this research by Mrs. Anne Shillington, a teacher who is presently a graduate student in Educational Psychology.

In this study, we are investigating certain abilities and performance among high school students which may not always be reflected in school achievement or by a student's measured potential. These abilities are sometimes identified as talents or thought to be indicative of creative thinking potential. They are often strongly related to or evident in extra-curricular activities and out-of-school interests and achievements. In identifying such abilities and , in some cases, actual performance, it is our hope that such information , combined with information on school achievement, will further improve the school's challenge to meet the needs of students, some with very exceptional abilities. On a more personal basis, it is felt that students participating in the project will benefit in relating their interests and present activities to career choices and "real- life" goals.

All students in Grade 11 will be given the opportunity to participate in this study. A letter is being sent to the parents of these students to obtain signed consent to have their son/daughter participate. Parents who consent are also being asked to complete a rating scale on their son/daughter, pertaining to certain aspects of the study.

Students with signed consent will be involved in the study for two (2) blocks of instructional time to complete the following tasks:

1. a group-administered test of general ability
2. a measure of creative thinking
3. a checklist of activities reflecting talent or creative performance
4. an informal inventory of interests, achievements, out-of-school activities - e.g. employment

We will administer the four tasks to all **students with consents in Blocks 1 and 4 on Friday, October 23, 1987.** A list of students from your block, who will be participating in the study, will be distributed in advance. We ask your cooperation in releasing the identified students for those times.

In **mid-November**, some of you will be asked to complete a rating scale on approximately 20 students you are teaching this semsester and possibly taught last year in a Grade 10 course.

We look forward to working with you and will strive to keep you informed and involved in this study.

THANK YOU !!!

Appendix B

Wallach & Kogan Creativity Measures

The "creativity" measures developed by Wallach & Kogan (1965) and adapted in research by Wallach & Wing (1969) are concerned with the measurement of "divergent thinking" and, more specifically, "ideational fluency" and "originality", or "number of ideas" and "uniqueness of ideas" respectively. Four probes, two verbal and two figural, are used. The authors explain the aim of including several probes was "...simply to increase reliability of measurement by sampling a diverse range of task stimuli whose ideational responses would vary both in number and in relative uniqueness for different individuals" (Wallach & Wing, 1969, p. 31).

TESTS

Uses

Instructions to the student:

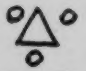
> On each of these pages will appear the name of a familiar object. We would like you to write down all the different ways you can think of in which the object might be used. Do not hesitate to write down whatever ways you can think of in which the object might be used as long as they are possible uses for the object that is named.

The first object named was "**a newspaper,**" the second, "**an automobile tire - either the tube or the outer tire,**" and the third," **a shoe.**" Each is listed on the top of a fresh sheet of blank 8 1/2 by 11 in. paper, with the reverse side of each sheet also available for writing down further ideas if the student is so inclined. Similar practices are followed for the other tasks as well.

Pattern Meanings

Instructions to the student:

> On each of these pages will appear a pattern of particular sort. We would like you to write down all the different things you can think of that each complete pattern might suggest. You can turn the pattern around any way you like. Do not hesitate to write down whatever things you can think of, as long as they are possible things that the pattern might suggest.

On top of each of three blank sheets appeared one of the patterns displayed (eg. ). These abstract forms simply serve to provide representationally ambiguous visual materials that are open to numerous alternative interpretations.

Similarities

Instructions to the student:

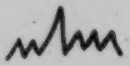
> On each of these pages will appear the names of two objects. We would like you to write down all the different ways you can think of in which the two objects might be alike. Do not hesitate to write down whatever ways you can thinkk of in which the two objects might be alike, as long as they are possible similarities between the objects.

The pairs of objects listed on the top of successive blank sheets were, first, **"a potato and a carrot,"** second, **"a train and a tractor,"** and third, **"a grocery store and a restaurant."**

Line Meanings

Instructions to the student:

> On each of these pages will appear a continuous line of a particular sort. We would like you to write down all the different things you can think of that each complete line might suggest. You can turn the line around any way you like. Do not hesitate to write down whatever things you can think of, as long as they are possible things that the line might suggest.

On top of each blank sheet appears the line drawing (eg. ). They serve to increase further the range of visual stimuli for which construals as to possible meanings are requested.

SCORING

Number of Ideas

A simple count of, in the case of each of the three items comprising each of the four tasks, the mumber of ideas which the student writes down.

Uniqueness of Ideas

A count of, again for each item on each task, those of a student's ideas that are fully unique in the sense that he/she is the only member of the sample to think of the given idea as a response to the response in question. Ambiguities will arise concerning whether two ideas offered by different individuals as uses for a shoe, for example, *really* should be considered different - and hence, potentially unique if no one else in the sample turned out to think of either one - or rather should be judged equivalent and hence nonunique. A manual was written to assist in such judgements.

Main principles contained in the manual:

(a) Different terms which have the same meaning are considered to be the same. For example, "toy" and "plaything" are categorized as the same use for a shoe.

(b) Singular and plural responses are considered to be the same in the case of the verbal items. For instance, "line garbage can" and "line garbage cans" are categorized as the same use for a newspaper. In the case of visual items, on the other hand, singular and plural responses are not considered to be the same because different images are involved: the student envisions a different percept in each case.

(c) Such phrases as "part of", "piece of", or "article of," are treated as irrelevant when they refer to a collective concept. For example, "piece of string" and "string" are categorized as the same response for the second item in the line meanings task. The aforementioned kind of phrases retained as meaningful, however, when they refer to a discrete concept, because different images are envisioned. For instance, "part of a racetrack" and "racetrack" are categorized as different responses for the second item in the pattern meanings task.

(d) References to the position of the viewer are treated as irrelevant. For instance, "upside-down vase" and "vase" are classified as the same response for the third item in the line meanings task.

(e) Qualifiers representing varying degrees of endorsement are considered to be the same. For example, in relation to similaritiesbetween a potato and a carrot, the following responses are taken as equivalent: "always peeled," "usually peeled," "often peeled," "normally peeled," "sometimes peeled," and "peeled." Analogously, qualifiers representing varying degrees of nonendorsement are considered to be the same. For instance, the following responses are taken as equivalent similarities for train and tractor: "never colored white," "seldom colored white," and "not colored white."

Adapted from Wallach & Wing (1969), pp. 31 - 36.

INTEREST INVENTORY

NAME:______________________________ **BIRTHDATE:** ____________
Yr. Mo. Day

GENDER: M F [Circle one] **RESIDENCE:** S. G. (City)___ S.P. (Town) ___ Acreage ___ Farm __
[Check one]

COURSES REGISTERED IN FOR 1987-88.

Semester 1	Semester 2

EMPLOYMENT PREFERENCES / CAREER GOALS:

Please list below two or three job preferences and /or career goals you are hoping to pursue once you complete your high school education.

____
____
____
____
____
____
____
____

Please list below two or three hobbies, leisure-time activities or "top priority" interests which occupy your time not taken up by school work.

____
____
____
____
____
____
____
____

THANK YOU FOR SHARING ! ! !

Student's Name:____________________ **I.D. #**__________
SURNAME FIRST

CREATIVE ACTIVITIES CHECKLIST

Mark A. Runco, Ph. D.
University of Hawaii, Hilo

INSTRUCTIONS TO THE STUDENT:

This is an **inventory, not a test.** It is simply a list of **activities and accomplisments**, and you are to indicate the **response** that **best describes how often** you have you have been **involved** in each particular activity. We suggest you may want to think back over the past **two to three years** on those activities and accomplishments which may not have been associated with school but with your own personal pursuits. Be sure to answer each question.

How many times have you...

1. Written poetry?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

2. Written lyrics to a song?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

3. Written a clever or humorous letter?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

4. Written a short story?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

5. Written a serious essay?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

6. Won an award for something you wrote?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

7. Written jokes, limericks, or the like?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

Now think about your most creative writing projects. Briefly describe one or two of them, and give details of how they were used. For example, were they printed in a newspaper or a magazine, or sent to a relative?

How many times have you...

8. Given a musical recital?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

9. Written music for an instrument?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

10. Recorded your playing an instrument?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

11. Won an award for musical accomplishment?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

12. Participated in an orchestra?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

13. Participated in a small band?

1	2	3	4
Never	Once or twice	Three to Five	Six or More

14. Entered a music contest?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

Now think about your most creative musical projects. Briefly describe one or two of them, and give details of how they were used. For example, were they recorded, played by another person, or used in a stage play?

How many times have you...

15. Made a craft out of metal?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

16. Made candles?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

17. Designed or made your own greeting card?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

18. Built a hanging mobile?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

19. Constructed a puppet?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

20. Made a craft out of plastic, glass, or similar material?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

21. Made a craft out of leather?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

22. Made a ceramic craft?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

23. Designed or made a piece of clothing?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

24. Cooked an original dish?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

25. Prepared a floral arrangement?

1 Never | 2 Once or Twice | 3 Three to Five | 4 Six or More

How many times have you...

26. Made jewelry?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

27. Planned or kept your own garden?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

28. Made a craft out of wood?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

29. Designed and made a costume?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

30. Participated in a craft workshop?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

31. Knitted or crocheted something?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

32. Made your own holiday decorations?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

Now think about the most creative crafts you have ever made. Briefly describe a few of them, and give details of how they were used. For example, were they displayed in a show? Given as gifts? Who viewed them, or where were they exhibited?

How many times have you...

33. Painted a picture?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

34. Sculpted something?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

35. Drawn a cartoon?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

36. Received an award for your artwork?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

37. Drawn a picture of yourself?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

38. Given something you made as a gift?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

Now think about the most creative works of art you have produced. Briefly describe a few of them, and give details about how they were used. For example, were they displayed in some show or exhibit? Were they gifts? Did they win prizes?

How many times have you...

39. Constructed a radio, camera, telescope, or other scientific apparatus?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

40. Designed an experiment?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

41. Entered a science contest?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

42. Applied math in an original way to solve a problem?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

43. Written an original computer program?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

44. Won a prize for a science project?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

45. Dissected an animal or plant?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

Now think about your most creative science activities.

Briefly describe a few of them, and explain how they are used. For example, was your experiment used by other people, or published? Did someone else use the apparatus you designed or built?

How many times have you...

46. Acted in a play?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

47. Given a recital?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

48. Received an award for acting or a recital?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

49. Choreographed a dance?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

50. Entered a talent contest?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

51. Worked on the set of a play?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

52. Directed a play?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

53. Sung in a play or musical?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

54. Participated in a drama or dance workshop?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

Now think about the most creative drama or dance projects you have ever been involved in. Describe a few of them briefly, and give details about where the performance occured, who the audience was, and so on. For example, was it a school play? Did you help choreograph or direct?

How many times have you...

55. Entered a speech contest?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

56. Written a speech?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

57. Taken photographs?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

58. Developed your own photographs?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

59. Designed a game?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

60. Made a movie or videotape?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

How many times have you...

61. Made a musical instrument?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

62. Designed or built a parade float?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

63. Planned or organized a school event?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

64. Won an award for speech or debate?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

65. Made-up magic tricks?

1	2	3	4
Never	Once or Twice	Three to Five	Six or More

Now list any creative activities in which you are or have been engaged. Briefly describe a few of these, and explain how the product of your activity was used, who viewed it, or if you were the only audience. Take your time!

Creative Activities Checklist (CAL)

Quality Scoring Criteria

Scoring consists of three dimensions, each with three levels:

I. Initiative

1 = None = Someone else's idea.

2 = Some = Adds to original idea.

3 = All own idea and plan.

II. Motivation

1 = Extrinsic (eg. an assignment)

2 = Some of own.

3 = Instrinsic (all own)

III. Purpose, Use or Application

1 = None

2 = A show of some sort - some public demonstration

3 = High-level public demonstration (eg. publication, art show)

I	II	III	Domain Score	I	II	III	Domain Score
1	1	1	1	1	2	3	6
1	1	2	2	2	2	3	7
1	1	3	3	1	3	3	8
1	2	2	4	2	3	3	9
2	2	2	5	3	3	3	10

PARENTS' EVALUATION OF STUDENTS' CREATIVITY

INSTRUCTIONS FOR COMPLETING RATING SCALE

1. One parent or both parents, working together, may complete the rating scale.
2. Please do not consult or discuss the rating scale with your son/daughter.
3. Be sure to (a) distribute your responses across all seven possible answers, (b) take your time and carefully consider each item, and (c) remember that your ratings are completely confidential.

** If you have any questions, please contact researcher as indicated on your letter.

THANK YOU FOR YOUR PARTICIPATION !!!

TEACHERS' EVALUATION OF STUDENTS' CREATIVITY

INSTRUCTIONS FOR COMPLETING RATING SCALE

1. Please complete a rating scale for each student indicated.
2. Be sure to (a) distribute your responses across all seven possible answers, (b) take your time and carefully consider each item, and (c) remember that your ratings are completely confidential.

** If you have any questions, please contact Jim Orieux at Student Services - 963-2231 [Ext. 376].

THANK YOU FOR YOUR PARTICIPATION !!!

STUDENT'S NAME: ______________________ I.D. #: ______________ (Researcher use only)

____

Rating Scale
1. Rarely
2. Very Little
3. Slightly
4. Moderately
5. Considerably
6. Very Much
7. Extremely

- -

Using the rating scale given above, to what degree or how often is your son/daughter ▪▪▪

1.	Self -Directed	1	2	3	4	5	6	7
2.	Curious	1	2	3	4	5	6	7
3.	Conforming	1	2	3	4	5	6	7
4.	Original	1	2	3	4	5	6	7
5.	Artistic	1	2	3	4	5	6	7
6.	Inflexible	1	2	3	4	5	6	7
7.	Intelligent	1	2	3	4	5	6	7
8.	Interested in Many Things	1	2	3	4	5	6	7
9.	Exploratory	1	2	3	4	5	6	7
10.	Insensitive	1	2	3	4	5	6	7
11.	Unique	1	2	3	4	5	6	7
12.	Innovative	1	2	3	4	5	6	7
13.	Flexible	1	2	3	4	5	6	7

Rating Scale
1. Rarely
2. Very Little
3. Slightly
4. Moderately
5. Considerably
6. Very Much
7. Extremely

……

Using the rating scale given above, to what degree or how often is your son/daughter ...

14. Unoriginal 1 2 3 4 5 6 7
15. Imaginative 1 2 3 4 5 6 7
16. Always questioning 1 2 3 4 5 6 7
17. Nonconforming 1 2 3 4 5 6 7
18. Challenging 1 2 3 4 5 6 7
19. Uninhibited 1 2 3 4 5 6 7
20. Independent 1 2 3 4 5 6 7
21. Sensitive 1 2 3 4 5 6 7
22. Expressive 1 2 3 4 5 6 7
23. Inventive 1 2 3 4 5 6 7
24. Good at Designing Things 1 2 3 4 5 6 7
25. Creative 1 2 3 4 5 6
7

……

THANK YOU !!!

Provincial Achievement Test (PAT) - Summary

Part A: Written Composition

Students' compositions are scored in terms of:

a) Content
b) Development
c) Sentence Structure
d) Vocabulary
e) Conventions

Each of these five areas is rated as:

5 - Exceptional
4 - Proficient
3 - Satisfactory
2 - Limited
1 - Poor
0 - Insufficient

Total Possible Marks = 25

Part B: Reading (Multiple Choice)

After reading short selection, students answer multiple choice questions dealing with:

1. Main Idea (10 questions)
2. Supporting Detail (11 questions)
3. Vocabulary (14 questions)
4. Organization of Events and Ideas (13 questions)
5. Conclusions (16 questions)

The five question areas are divided among three cognitive levels:

1. Literal Understanding (6 questions)
2. Inferential Understanding (34 questions)
3. Evaluation (24 questions)

Total Possible Marks: 64

PA Composite Score (PATOT)

A student's overall score on the Provincial Achievement Test is determined as follows:

Test Selection	Total Marks	Weighting
Part A: Written Composition (PAWR)	25	50%
Part B: Reading - Multiple Choice (PAMC)	64	50%

Therefore, each student receives three separate marks: PATOT, PAWR, and PAMC.

Appendix C

Table C.1

TESC: Number of Students Rated by Teachers in Different Subject Areas

Subject Area	Teachers	Students
English	8	52
Social Studies	8	55
Math	4	11
Science	1	1
French	2	6
Music	1	10
Performing Arts	1	6
Psychology	1	9
Vocational/Business Ed.	6	7
N=	32	157

Table C.2

Chronological Age in Months: Means, Standard Deviations, and Ranges for Grade 11 Students

	N	Mean	S.D.	Range
Male	81	196.89	4.95	188-210
Female	76	195.53	4.52	186-208
Total	157	196.23	4.78	186-210

Table C.3

O-LSAT Deviation IQ Score (DIQs):Means, Standard Deviations, and Ranges for Grade 11 Students

	N	Mean	S.D.	Range
Male	80	110.60	13.70	77-150
Female	76	114.55	12.15	82-144
Total	156	112.53	13.08	77-150

Table C.4.

Provincial Achievement Test - Language Arts 9 (1986): Means and Standard Deviations for Grade 11 Students.

	N	Total Score Mean	Total Score S.D.	Mult. Choice Mean	Mult. Choice S.D.	Writ. Response Mean	Writ. Response S.D
Male	76	67.88	13.20	67.04	14.41	68.79	17.13
Female	75	72.47	11.62	71.16	11.81	73.71	15.42
Total	151	70.16	12.61	69.09	13.30	71.23	16.44

Note. Scores are expressed as percentages.

Table C.5.

Grade 10 Final Marks in Social Studies (June, 1987):Means, Standard Deviations and Ranges for Grade 11 Students.

	N	Mean	S.D.	Range
Male	79	63.63	15.09	24-97
Female	75	64.91	13.11	24-90
Total	154	64.25	14.13	24-97

Note. Marks are expressed as percentages.

Table C.6.

Grade Point Average of Grade 10 English, Math, and Social Studies Final Marks (June, 1987):Means, Standard Deviations and Ranges for Grade 11 Students.

	N	Mean	S.D.	Range
Male	78	61.14	12.29	33.3-86.3
Female	74	64.10	9.82	38.0-87.3
Total	152	62.58	11.33	33.3-87.3

Note: Marks expressed as percentages.

Table C.7

Parents' Evaluation of Students' Creativity (PESC):Means, Standard Deviations and Ranges for Grade 11 Students

	N	Mean	S.D.	Range
Male	81	4.57	0.71	3.00-6.86
Female	76	4.68	0.65	2.86-6.05
Total	157	4.62	0.68	2.86-6.86

Note. Values are expressed as ratings from 1 - 7.

Table C.8

Teachers' Ratings of Students' Creativity (TESC): Means, Standard Deviations, and Ranges for Grade 11 Students

	N	Mean	S.D.	Range
Male	81	4.11	0.94	2.10-6.64
Female	76	4.31	0.86	2.19-6.10
Total	157	4.21	0.90	2.10-6.64

Note: Values are expressed as ratings from 1 -7

Table C.9

Divergent Thinking Test (DT) - Fluency Scores:
Means and Standard Deviations for Grade 11 Students

		Comp.		Uses		Patt.		Sim.		Line	
	N	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Male	81	69.06	25.54	23.62	9.82	14.20	6.58	15.75	5.78	15.94	7.39
Female	76	83.46	32.90	26.93	11.61	18.50	10.33	18.03	6.78	20.00	9.86
Total	157	76.03	30.12	25.22	10.82	16.28	8.84	16.85	6.37	17.90	8.88

Table C.10

Divergent Thinking Test (DT) - Unusual Response Score:
Means and Standard Deviations for Grade 11 Students

		Comp.		Uses		Patt.		Sim.		Line	
	N	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Male	81	21.73	13.53	5.88	5.36	8.51	5.06	1.49	1.53	5.85	4.64
Female	76	27.43	19.82	6.89	6.18	10.37	7.66	1.63	1.73	8.54	7.12
Total	157	24.49	17.06	6.37	5.77	9.41	6.50	1.56	1.62	7.15	6.10

Table C.11

Creative Activities Checklist (CAL)-Quantitative Scores: Means and Standard Deviations for Grade 11 Student

		Comp.		Lit.		Mus.		Craft		Art		Sci.		P.Art		P.Pres.	
	N	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Male	81	1.92	0.30	2.52	0.54	1.59	0.62	2.04	0.44	2.16	0.68	1.947	0.40	1.80	0.35	1.80	0.35
Female	76	2.07	0.32	2.72	0.46	1.76	0.69	2.26	0.44	2.17	0.63	1.79	0.43	1.83	0.54	1.86	0.40
Total	157	1.99	0.32	2.62	0.51	1.67	0.66	2.15	0.45	2.16	0.65	1.86	0.49	1.65	0.50	1.83	0.37

Note: Values are based on rating scale of 1-4.

Table C.12

Creative Activities Checklist (CAL)-Qualitiative Scores:
Means and Standard Deviations for Grade 11 Students

		Comp.		Lit.		Mus.		Craft		Art		Sci.		P.Art		P.Pres.	
	N	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Male	81	2.73	1.67	3.14	2.87	2.48	2.78	3.15	2.25	2.83	2.81	2.37	2.60	2.19	2.19	3.00	2.94
Female	76	3.80	1.67	4.25	2.85	3.14	2.58	4.42	2.32	4.18	2.93	2.18	2.26	4.00	2.32	4.36	3.04
Total	157	3.24	1.74	3.68	2.91	2.80	2.70	3.76	2.36	3.48	2.94	2.28	2.43	3.06	2.42	3.66	3.06

Note: Values based on rating of 1-10

Table C.13

Pearson Correlation Coefficients: CAL with DT Fluency for Grade 11 Students (N=157)

	CAL Quant.							
DT Fl.	Comp.	Writ.	Mus.	Craft	Art	Sci.	P. Ar	P. Pres.
Comp.	.358***	.367***	.184*	.305***	.124	.047	.248**	.197**
Uses	.314***	.368***	.103	.279***	.078	.108	.179*	.201**
Patt.	.287***	.261***	.185*	.229**	.087	.006	.235**	.148
Sim.	.289	.263***	.171*	.230**	.077	.030	.273***	.147
Line	.333***	.336***	.181*	.300***	.159*	.061	.167*	.167*
	CAL Qual.							
Comp.	.340***	.226**	.194*	.271***	.171*	.078	.315***	.28**
Uses	.295***	.166*	.153	.270***	.168*	.102	.212**	.268**
Patt.	.259***	.176*	.156*	.221**	.094	-.012	.292***	.241**
Sim.	.377***	.292***	.233**	.261***	.158*	.175*	.321***	.275***
Line	.276***	.193*	.122	.196**	..174*	.079	.257***	.222*

* p <.05
** p <.01
*** p <.001

Table C.14

Pearson Correlation Coefficients: CAL with DT Unusual Responses for Grade 11 Students (N=157)

	CAL Quant.							
DT Un.	Comp.	Writ.	Mus.	Craft	Art	Sci.	P. Art	P. Pres.
Comp.	.348***	.356***	.187*	.271***	.124	.122	.246**	.169*
Uses	.289***	.345***	.121	.194**	.088	.150	.228**	.188*
Patt.	.295***	.264***	.195**	.232**	.092	.076	.213**	.133
Sim.	.188*	.233**	.051	.108	.043	.076	.223**	.065
Line	.335***	.325***	.187*	.299***	.153	.098	.186*	.134
	CAL Qual.							
Comp.	.355***	.262***	.174*	.259***	.195**	.125	.294***	.290***
Uses	.335***	.224**	.140	.282***	.219**	.152	.244**	.252**
Patt.	.320***	.232**	.220**	.237**	.139	.065	.289***	.259***
Sim.	.229**	.206**	.034	.202**	.096	.108	.139	.242**
Line	.274***	.218**	.111	.151	.165*	.108	.247**	.232**

* p <.05
** p <.01
*** p <.001

Table C.15

Pearson Correlation Coefficients: DT with PESC and TESC for Grade 11 Students (N=157)

	Comp.	Uses	Patt	Sim.	Line
			Fluency		
PESC	.358**	.375**	.253**	.268**	.288**
TESC	.394**	.353**	.347**	.292**	.336**
			Unusual		
	Comp.	Uses	Patt	Sim.	Line
PESC	.325**	.330**	.255**	.259**	.256**
TESC	.398**	.376**	.392**	.181*	.291**

* p <.05

** p <.001

Table C.16

Pearson Correlation Coefficients: CAL with PESC and TESC for Grade 11 Students (N=157)

	CAL Quant.							
	Comp.	Writ.	Mus.	Craft	Art	Sci.	P. Art	P. Pres.
PESC	.394***	.264**	.116	.345***	.231**	.252***	.275***	.228**
TESC	.257***	.319***	.168*	.171*	.043	.062	.250**	.115
	CAL Qual.							
PESC	.340***	.229**	.189*	.186*	.174*	.289***	.176*	.289***
TESC	.313***	.319***	.174*	.176*	.161*	.116	.211**	.225**

* p <.05
** p <.01
*** p <.001

Table C.17

Pearson Correlation Coefficients: CAL with Intellectual Ability and Academic Achievement for Grade 11 Students.

		CAL Quant. (N=157)							
	N	Comp.	Writ.	Mus.	Craft	Art	Sci.	P. Art	P. Pres.
OLSAT	156	.104	.282***	.047	.041	.000	.100	.086	.008
PATOT	150	.138	.260***	.103	.038	.028	.050	.105	.098
PAMC	150	.142	.279***	.148	.034	-.012	.101	.099	.077
PAWR	150	.106	.179*	.043	.041	.053	-.002	.088	.093
S.S. 10	153	.185*	.268***	.181*	.114	-.033	.215**	.071	.093
GPA	151	.214**	.331***	.149	.139	.027	.216**	.073	.106
		CAL Qual. (N=157)							
OLSAT	156	.405***	.297***	.107	.278***	.281***	.238**	.296***	.317***
PATOT	150	.381***	.323***	.144	.279***	.214**	.184*	.258***	.319***
PAMC	150	.410***	.331***	.175*	.286***	.221**	.242**	.274***	.323***
PAWR	150	.253**	.225**	.084	.201**	.151	.088	.177*	.220**
S.S. 10	153	.385***	.335***	.204**	.353***	.089	.263***	.250**	.256***
GPA	151	.439***	.352***	.188*	.385***	.222**	.266***	.283***	.296***

* p <.05
** p <.01
*** p <.001

Table C.18

Pearson Correlation Coefficients: DT with Intellectual Ability and Academic Achievement for Grade 11 Students

	OLSAT	PATOT	PAMC	PAWR	[illegible]S 10	GPA	
	N=156		150	150	150	153	151
DT Fl (N=157)							
Comp.	.408***	.388***	.381***	.286***	.422***	.469***	
Uses	.346***	.384***	.358***	.298***	.364***	.387***	
Patt.	.314***	.264 **	.253 **	.198 *	.314***	.367***	
Sim.	.384***	.339***	.345***	.243 **	.372***	.379***	
Line	.380***	.326***	.322***	.236 **	.412***	.471***	
DT Un (N=157)							
Comp.	.434***	.355***	.364***	.247 **	.429**	.474***	
Uses	.390***	.336***	.349***	.233 **	.380**	.396***	
Patt.	.376***	.295***	.298***	.208 **	.376**	.425***	
Sim.	.380***	.268***	.311***	.153	.272***	.322***	
Line	.343***	.288***	.285***	.208 **	.363**	.410***	

* p<.05
** p<.01
*** p<.001

Appendix D

Least Creative Group - Profile Summary

Gender: 3 male/1 female **Age:** 15-8 to 16-11 **Res:** City/Town

IQ: 88 - 117

ACH:	PATOT	PAMC	PAWR	Eng. 13	Ma. 13	SS 10	GPA
	34-65	25-62	28-64	34-64	30-67	30-52	33-56

CR:	PESC	TESC	DTFL	DTUN	CALQT	CALQL
	3.19-3.57	2.19-4.10	24-40	4-8	1.14-2.25	57-1.0

Grade 11 Courses

English 23	(3)	Sociology 20	(3)
Math 23	3)	Law 20	(1)
Typing 20	(1)	P.E. 20	(1)
Economics 20	(1)	Work Exp. 25/35	(1)
Geography 20	(1)	Food Science 20	(1)
Mechanics 20	(1)	Bldg. Const. 22	(1)
Psychology 20	(1)	Ind. Ed 20	(1)

Grade 10 Courses

English 13	(1)
Math 13	(3)
Soc. St. 10	(2)
Music 10	(1)
Office Prac. 20	(1)

Career/Employment Preferences

1. carpenter or lawyer
2. mechanic
3. tradesman or fireman or policeman (3)
4. secretary or marine biologist
5. would like to get as much high school to "master it all"

Leisure/Hobbies/Interests

1. baseball (2), sports, hockey
2. reading magazines
3. fooling around with friends (2)
4. listening to music (2)
5. girls
6. cars (2), motor bikes

CAL Activities

1. Pottery - decorations for my room
2. made a wreath and a nutcracker
3. made apron and a pair of sweats in Home Ec.
4. wrote story or poem and sent to a friend
5. acted in a play at school

Most Creative Group - Profile Summary

Gender: 2 male/2 female **Age:** 15-8 to 16-6 **Res:** City/Town/Acreage

IQ: 122-135

ACH:	PATOT	PAMC	PAWR	Eng. 10	Ma. 10	SS 10	GPA
	67-95	70-89	60-100	70-80	56-90	72-82	67.7-84

CR:	PESC	TESC	DTFL	DTUN	CALQT	CALQL
	5.57-6.05	4.67-6.64	88-158	44-72	2.02-2.89	4.57-6.87

Grade 11 Courses

English 20 (4)
Math 20 (4)
Physics 20 (2)
Art 20 (1)
Social Studies 20 (2)
Biology 20 (3)
Chemistry 20 (4)
Perf. Arts 20 (1)
French 20 (2)
Drama 20 (1)
Band 20 (1)
Sociology 20 (1)
Drafting 20 (1)
Typing 20 (1)
Choral 20 (1)
Psychology 20(2)

Career/Employment Preferences

1. Architecture or Professional Engineer (Civil)
2. Psychologist
3. High School teacher - Psychology/Sociology/English/Drama (2)
4. Counsellor or public speaker
5. Actress
6. Business Woman
7. Enter seminary
8. something in the field of art
9. entertainment career

Leisure/Hobbies/Interests

Leisure/Hobbies/Interests

1. sports activities (unspecified)
2. cheerleading and dancing
3. going to movies and live theater
4. Church (youth group and Bible study)
5. Acting with performing arts group (2)
6. exercising
7. horseback riding
8. reading of both fiction and non-fiction, especially history and biographies; classics, poetry, world religions, the Bible
9. writing and drawing - planning of things that usually don't get done, though working at changing that
10. art (drawing)
11. playing guitar

CAL Activities

1. Poetry published in newspaper and books.
2. plays flute
3. Choreographed dance and cheers for cheerleading squad.
4. Active in Student's Council - organizing activities.
5. Sang in the school musical.
6. Watercolour painting entered in contest.
7. Organized and was Master of Ceremonies for a school concert.
8. Ran for Grade 10 Representative on Student's Council.
9. Participated in the School Band Wind Ensemble; played duets; entered Kiwanis Festival.
10. Displayed art work at the local fair.
11. Writing a continuing story in a series of church youth newspapers.
12. Participated in a band and helped record a demo tape.
13. Enjoys drawing a lot - personal satisfaction rather than display.
14. Works on stereos, VCR's, musical (electronic) instruments.
15. Very active in drama group through church; performed in Edmonton; has written one skit for the group.
16. Enjoys entertaining friends with humor, jokes - considers this a creative ability.